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(54) **Extension screed for a paving vehicle**

Ausziehbohle für einen Straßenfertiger

Extension de poutre lisseuse pour véhicule de pavage

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(73) Proprietor: **BLAW-KNOX CONSTRUCTION EQUIPMENT CORPORATION**
Mattoon,
Illinois 61938-4600 (US)

(72) Inventors:
- **Rahn, Christopher W.**
  Pleasant Plains, IL 62677 (US)
- **Eppes, Michael S.**
  Elmhurst, IL 60126 (US)
- **Potter, Eric**
  Valley Center, KS 67147 (US)

(74) Representative: **Kramer - Barske - Schmidtchen**
Landsberger Strasse 300
80687 München (DE)

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Description

[0001] The present invention relates to paving vehicles, and more particularly to extension screed assemblies for paving vehicles.

[0002] Screed assemblies for paving vehicles are known and generally include a main screed having a frame connectable with a paver tractor and one or more screed plates mounted to the bottom of the frame. Often, screed assemblies often include extension screeds mounted to the front or rear of the main screed so as to be laterally movable with respect to the main screed. Such extension screeds provide the capability of forming a wider mat of paving material when the extensions are displaced laterally outwardly and to produce narrower mats when the extensions have been displaced inwardly toward the center of the main screed.

[0003] EP 1 239 082 A2 discloses an extension screed having a telescoping tube driven by a hydraulic cylinder for extending and retracting the extension screed in the horizontal direction with respect to a screed base member. The telescoping tube is fixedly connected to a cross-bar, such that the cross-bar is movable only in the horizontal direction. A bottom part supports an extension screed plate and is vertically movably connected to the cross-bar via two height adjusting devices. The bottom part is also pivotably attached to the screed base member via a catch arrangement. Thus, the extension screed plate can be moved in both the horizontal and vertical directions.

[0004] DE 100 28 819 A 1 discloses the features of the preamble of independent claim 1 and shows an extension screed assembly having support portions that are vertically movable relative to a main screed by means of a threaded rod. Extension screed supports are respectively connected to the support portions and hydraulic cylinders may be provided to horizontally move the extension screed supports with respect to the main screed.

[0005] It is an object of the present invention to provide an improved screed.

[0006] This object is achieved by the invention of the appended claim 1.

[0007] Further developments of the invention are recited in the dependent claims.

[0008] The present invention is an extension screed for a screed assembly of a paving vehicle, the screed assembly including a main screed. The extension screed comprises a base movably connectable with the main screed and a vertical actuator connectable with the main screed. The vertical actuator is configured to linearly displace the base with respect to the main screed in opposing, generally vertical directions. A carriage is movably connected with the base and is configured to support a screed plate. Further, a horizontal actuator is connected with the base and is configured to linearly displace the carriage with respect to the base in opposing, generally horizontal directions.

[0009] The foregoing summary, as well as the detailed description of the preferred embodiments of the present invention, will be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there is shown in the drawings, which are diagrammatic, embodiments that are presently preferred. It should be understood, however, that the present invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:

Fig. 1 is a rear perspective view of a screed assembly having two of the extension screeds in accordance with the present invention;

Fig. 2 is a rear perspective view of one half of the screed assembly with one extension screed;

Fig. 3 is a side elevational view of a screed assembly half, shown with the extension screed in a fully extended and pivoted position;

Fig. 4 is an enlarged rear perspective side of the extension screed shown separate from the screed assembly and in an intermediate extended position;

Fig. 5 is a rear perspective view of the extension screed shown in a fully extended position;

Fig. 6 is a rear perspective view of the extension screed in an alternative intermediate extended position;

Fig. 7 is a rear perspective view of a main screed half with two preferred vertical actuators of the extension screed;

Fig. 8 is a side perspective view of a main body of a preferred base portion of the extension screed;

Fig. 9 is an exploded perspective view of three frames of a preferred carriage of the extension screed;

Fig. 10 is a more diagrammatic, top plan view of the extension screed, shown in a retracted position;

Fig. 11 is another view of the extension screed of Fig. 10, shown in an intermediate extended position;

Fig. 12 is another view of the extension screed of Fig. 10, shown in a fully extended position;

Fig. 13 is a more diagrammatic, side plan view of the extension screed, shown in a retracted position;

Fig. 14 is another view of the extension screed of Fig. 13, shown in an intermediate extended and elevated position;

Fig. 15 is another view of the extension screed of Fig. 13, shown in a fully extended and pivoted position; and

Fig. 16 is a top plan view of the screed assembly of Fig. 1, shown connected with a paving vehicle.

DETAILED DESCRIPTION OF THE INVENTION

[0010] Certain terminology is used in the following description for convenience only and is not limiting. The words "right", left", "lower", "upper", "upward", "down" and "downward" designate directions in the drawings to which reference is made. The words "inner", "inwardly" and "outer", "outwardly" refer to directions toward and

away from, respectively, a designated centerline 1a of a screed assembly 1 or a geometric center of an element of an extension screed 10 being described, the particular meaning being readily apparent from the context of the description. Further, the word "lateral" and "laterally" refer to elements of the extension screed 10 or screed assembly 1 that are oriented so as to extend at least partially in a direction generally perpendicular to the screed centerline 1a. Furthermore, as used herein, the word "connected" is intended to include both direct connections between two members without any other members interposed therebetween and indirect connections between members in which one or more other members are interposed therebetween. The terminology includes the words specifically mentioned above, derivatives thereof, and words or similar import.

[0011] Referring now to the drawings in detail, wherein like numbers are used to indicate like elements throughout, there is shown in Figs. 1-16 a presently preferred embodiment of an extension screed 10 for a screed assembly 1 of a paving vehicle 2. Such a screed assembly 1 has a longitudinal centerline 1a extending generally in a direction of vehicle travel (and thus paving operations) and includes a main screed 3 having at least one screed plate 4. The extension screed 10 basically comprises a base 12 movably connectable with the main screed 3 and a carriage 14 movably connected with the base 12 and configured to support a screed plate 11. Two vertical actuators 16 are connectable with the main screed 3 and are configured to linearly displace the base 12 with respect to the main screed 3 in opposing, generally vertical, upward and downward directions V_U, V_D, respectively. The vertical actuators 16 are also configured to alternatively pivot the base 12 with respect to the main screed 3 within a generally vertical plane P_v extending vertically through the base 12 (see Fig. 15). Further, a horizontal actuator 18 is connected with the base 12 and is configured to linearly displace the carriage 14 with respect to the base 12 in opposing, outer and inner, generally horizontal directions H_O and H_I, respectively, and thus laterally toward and away from, respectively, the screed assembly centerline 1a.

[0012] As the main screed 3 includes a screed plate 2 and the extension screed 10 further comprises a screed plate 11 mounted to the carriage 14, the extension screed 10 enables the relative positions of the two screed plates 3 and 11 to be adjustable generally in the following manner. When the base 12 and vertical actuators 16 are each connected with the main screed 3 as discussed below, the vertical actuators 16 are configured to displace the base 12 so as to adjust an elevational position of the extension screed plate 11 with respect to the main screed plate 2. In addition, the horizontal actuator 18 is configured to displace the carriage 14 so as to adjust a horizontal position of the extension screed plate 11 with respect to the main screed plate 4. Further, as the main and extension screed plates 4, 11, respectively, each have a lower horizontal working surface 4a, 11a, respectively, the vertical actuators 16 are configured to also pivot the base 12 with respect to main screed 3 so as to adjust a slope angle As between the extension screed plate surface 11a and the main screed plate surface 4a, as described in greater detail below.

[0013] Preferably, the base 12 includes two horizontally spaced-apart base members or portions 20A, 20B, each base portion 20A, 20B being movably connectable with the main screed 3. With such a base structure, the extension screed 10 includes the two vertical actuators 16, i.e., a first vertical actuator 17A and a second vertical actuator 17B, each being connected with a separate one of the two base portions 20A, 20B, respectively, and preferably removably mounted to the main screed 3. The two vertical actuators 17A, 17B are configured to linearly displace the connected base portion 20A, 20B, respectively, with respect to the main screed 3 in the opposing vertical directions V_U and V_D. More specifically, when the two vertical actuators 17A, 17B displace the base portions 20A, 20B by substantially the same distance d_v (e.g., d_0 in Fig. 14) with respect to the main screed 3, the carriage 14 and thus the extension screed plate 11 are each substantially vertically displaced with respect to the main screed 3. Further, when the two actuators 17A, 17B displace two base portions 20A, 20B by different vertical distances d_v (e.g., d_1, d_2 in Fig. 15) with respect to the main screed 3 or displace one base portion 20A or 20B while the other base portion 20B, 20A remains generally stationary, the carriage 14 and screed plate 11 are alternatively pivoted within the vertical plane P_v, as discussed in further detail below.

[0014] Further, the carriage 14 includes a first, inner section 22 movably connected with the base 12, and thereby connected with the main screed 3 through the vertical actuator(s) 16, and a second, outer section 24. The second carriage section 24 is movably connected with at least the first carriage section 22, and preferably also with the base 12 as discussed below, and is configured to directly support the screed plate 11. Further, the two preferred sections 22, 24 of the carriage 14 are each preferably displaceable along a common axis 25 extending through the entire carriage 14, as discussed in further detail below.

[0015] Preferably, the first, inner carriage section 22 includes a first generally rectangular frame 26 that at least partially bounds an interior space S_1 and the base 12 is preferably disposed with the first frame interior space S_1. The second, outer carriage section 24 preferably includes a second generally rectangular frame 28 that at least partially bounds an interior space S_2, the first frame 26 being disposeable at least partially within the second frame interior space S_2 such that the second carriage section 24 is displaceable about the first carriage section 26. In other words, the second, outer frame 28 is slidably disposed at least partially about the first frame 26 such that the second frame 28 "telescopingly" displaces with respect to the first frame 26 along the axis 25, as discussed in further detail below. Further, when the exten-

sion screed 10 is mounted to the main screed 3, the second, outer carriage section 24 provides a carriage outer end 14a spaced laterally from the centerline 1, the outer end 14a defining a variable, laterally-outermost position of the screed assembly 1, as discussed below.

[0016] With a carriage 14 constructed as described above, the extension screed 10 includes two horizontal actuators 18, specifically a first actuator 19 and a second actuator 21. The first horizontal actuator 19 is configured to linearly displace the first, inner frame 26 alternatively in the two outer and inner horizontal directions H_O, H_I with respect to the main screed 3. The second horizontal actuator 21 is configured to linearly displace the second, outer frame 28 with respect to the first frame 26 (and thus also with respect to the base 12) alternatively in the two horizontal directions H_O and H_I. Preferably, the two horizontal actuators 19 and 21 are each mounted to the base 12 such that both actuators 19, 21 are at least partially disposed within the first frame interior space S_1, as described in further detail below.

[0017] As best shown in Figs. 10-14, the extension screed 10 having the preferred carriage structure is laterally movable, so as to position the extension screed plate 11 to adjust the width W of a paving mat M formable by the screed assembly 1, in generally the following manner. The second horizontal actuator 21 is configured to displace the second carriage section 24 along the axis 25 such that the carriage outer end 14a moves between a first horizontal position P_1 (Fig. 10), at which the outer end 14a is spaced a first perpendicular distance D_1 from the centerline 1a, and a second horizontal position P_2 (Fig. 11). In the second horizontal position P_2, the carriage outer end 14a is spaced a second perpendicular distance D_2 from the centerline 1a, the second distance D_1 being greater than the first distance D_1. Thus, the carriage 14 moves laterally outwardly from the first position P_1 to the second position P_2, and vice-versa. Further, the first horizontal actuator 19 is configured to displace the first carriage section 22 along the axis 25 such that the carriage outer end 14a moves between the second horizontal position P_2 and a third horizontal position P_3 (Fig. 12). In the third position P_3, the carriage outer end 14a is spaced a third perpendicular distance D_3 from the centerline 1a, the third distance D_3 being greater than the second distance D_2.

[0018] Furthermore, the main screed 3 has a lateral outer end spaced 3a spaced (i.e., fixedly located) a fourth perpendicular distance D_4 (Fig. 10) from the centerline 1a and at least the second and third distances D_2, D_3 are each greater than the fourth distance D_4. Thus, the carriage 14 of the extension screed assembly 10 extends laterally outwardly from the main screed 3 when the carriage outer end 14a is disposed in at least one the second and third horizontal positions P_2, P_3, respectively, and preferably also when the carriage end 14a is located at the first position P_1, as depicted in Fig. 10. However, the extension screed 10 may be configured such that the outer lateral end 14a is spaced inwardly from the main screed outer end 3a, if desired. Further, the carriage 14 may be constructed with only a single section or frame (not shown), such that the carriage 14 only moves between first and second positions P_1, P_2 (and positionable or locatable at all positions therebetween), as discussed in further detail below. Having described the basic elements of the present invention above, the extension screed assembly 10 and the components thereof are now discussed in greater detail below.

[0019] Referring to Figs. 1-3 and 16, the extension screed 10 of the present invention is preferably used with a screed assembly 1 that is connected to the paving vehicle 2 by a pair of tow arms 5, such that the screed assembly 1 is towed from the rear 2a of the vehicle 2. In operation, the vehicle 2 and screed assembly 1 both travel generally along the screed centerline 1a, or more accurately stated, the arrangement of the screed 1 with respect to the vehicle 2 causes the screed assembly 1 to be centered about the line 1a extending longitudinally through the vehicle 2. Preferably, the extension screed 10 is used as a pair of extension screeds 10 spaced apart laterally so as to be disposed on opposing sides of the assembly centerline 1a, although a single extension 10 may be used if so desired. Further, the extension screeds 10 are each preferably mounted to the front end 3b of the main screed 3 and generally proximal to a separate main screed lateral end 3a, but may alternatively be mounted to the main screed rear end 3b or directly to the main screed lateral walls (not indicated) at each lateral end 3a. Preferably, the main screed 3 includes a main frame 6 formed of two laterally spaced frame halves 7 pivotally connected at the inner ends 7a of the frame halve 7. As such, the main screed 3 is "crownable" or pivotable about the centerline 1a, but may alternatively be formed of a single, fixedly connected frame or of three or more frame sections (no alternatives shown). In addition, each of the preferred frame halves 7 includes a separate screed plate 4 mounted to a lower end of the frame half 7, each main screed plate 4 having a lower working surface 4a.

[0020] Referring to Figs. 1-3 and 7, each main screed frame half 7 preferably includes a mounting portion or mount 8 configured to mount the vertical actuators 16, and preferably also the base 12, of one extension screed 10 to the screed 3. Each mount 8 includes a generally vertical base wall 30 providing a section of the screed frame half front wall 7b and two vertically spaced apart mounting plates 31 each extending rearwardly from the base wall 30. Each mounting plate 31 includes two outer bracket sections 32 connected by a central rib section 33, such that the plates 31 provide two pairs of upper and lower aligned bracket sections 32. Two tubular mounting bearings 35 each extend generally vertically between and through a separate one of the two pairs of aligned bracket sections 32 and each has a central bore 36 sized to slidably receive a slide post 40 of each of the preferred base portions 20A, 20B, as discussed in further detail below. Further, each pair of aligned bracket sec-

tions 32 includes a pair of upper and lower aligned openings 37, 39 sized to receive a separate one of the two vertical actuators 16, as described below.

[0021] Although the above screed mounting portions/mounts 8 are preferred, the extension screed 10 of the present invention may be movably connected to the main screed 3 by any appropriate means. For example, the main screed 3 may only have a single mount 8 (i.e., for mounting either a single or both extension screeds 10) or three or more mounts 8. Further for example, each extension screed 10 may be connected to the main screed 3 by a separate device, such as a bracket(s), attached to the screed front end 3 a, the rear end 3b, or to either side 3c or 3d and configured to connect the base 12 to the main screed 3. As yet another example, the base 12 (and thus the extension screed 10) maybe connected with the main screed solely through the one or more vertical actuators 16.

[0022] Referring now to Figs. 4-6 and 8, as discussed above, the base 12 preferably includes a first, inner base member or portion 20A and a second, outer base member or portion 20B, the two base portions 20A, 20B being spaced apart horizontally with respect to the main screed 1. Each base portion 20A, 20B is preferably removably connectable with the main screed 3, specifically by means of the mounting portions 7, as discussed above, but may alternatively be permanently or non-removably connected with the main screed 3 by any appropriate means. As shown in Fig. 15, with a base 12 having two separate portions 20A, 20B, when one of the two base portions 20A, 20B is displaced to a first vertical position p_{V1} spaced a first vertical distance d_1 from the main screed surface 4a (e.g., base portion 20A) while the other one of the two base portions 20A, 20B is located at a second vertical position p_{V2} spaced a second vertical distance d_2 from the main screed surface 4a, the first distance d_1 being greater than the second distance d_2, the carriage 14 is pivotally displaced with respect to the main screed 3 within a generally vertical plane P_V, as discussed in further detail below. However, if the base 12 were alternatively constructed of a single frame or body (not shown) as opposed to separate portions, the two vertical actuators 17A, 17B may be connected with such a base 12 so as to still be capable of vertically displacing and/or pivoting the extension screed 10, as discussed below. It must be noted that the positions of the base portions 20A, 20B are indicated by reference to a point "p" on each base portion 20A or 20B, the particular points selected having no particular relevance other than as a convenient point of reference for purposes of discussion of the present invention.

[0023] Preferably, the base portions 20A, 20B each include a body 38 and a slide post 40 attached to and extending vertically downwardly from the body 38. The base bodies 38 each preferably include a generally rectangular main section 42 and a connective section 44 extending generally horizontally and rearwardly from a rear vertical surface 42a of the body main section 42. The body main section 42 has upper and lower generally circular bearing openings 48A, 48B extending generally horizontally through the body section 42 between opposing left and right vertical surfaces 42c, 42d of the body section 42, each opening 48A or 48B being configured to receive and slidably support a portion of a first guide member 76, as described below. Preferably, each base body 38 has two circular through-holes 49 and a separate spherical bearing 50 disposed within each through hole 49, such that the bearing openings 48A, 48B are provided by the spherical bearings 50. Alternatively, the body through-holes 49 may each be sized to directly support each guide member 76, thus providing one bearing opening 48A or 48B, or the base portions 20A, 20B may each include one or two separate bearings (none shown) mounted at another appropriate location on the associated body 38, such as being attached to the front or rear vertical surfaces 42b, 42a, respectively, or upper or lower horizontal surfaces 42e, 42f, respectively. Further, a slotted relief opening 46 extends between the upper surface 42e of each body section 42 and the upper bearing opening 48A thereof. Each relief opening 46 provides space for a limited vertical displacement, relative to the base body 38, of the spherical bearing 50 disposed within the upper opening 48A, which is necessary when the two base portions 20A, 20B are displaced vertically relative to each other, as discussed in further detail below.

[0024] Further, each base body 38 also includes a generally rectangular, central through-hole 54 extending horizontally through the body main section 42 between the left and right vertical side surfaces 42c, 42d and is located vertically between the bearing openings 48. The central hole 54 provides clearance space to enable the first and second horizontal actuators 19, 21, respectively, to extend through both base portions 20A, 20B, as discussed below. The outer end 19a of the first horizontal actuator 19 is preferably pivotally mounted to the outer base portion 20B by means of a pivot pin 56 disposed within the body central hole 54, also as discussed further below. Preferably, the body main section 42 of the outer base portion 20B has a pair of aligned openings 55 extending into the central hole 54, one extending from the front surface 42a and the other extending from the rear vertical surface 42b. The pin 56 is installed through the two openings 55 and extends through the actuator inner end 19a to rotatably connect the first horizontal actuator 19 to the outer base portion 20B.

[0025] Still referring to Figs. 4-6 and 8, the connective arm section 44 of each base body 38 has a pair of upper and lower horizontal wall sections 58 extending outwardly from the main section rear vertical surface 42b and connected together by a vertical wall section 60 spaced horizontally from the main section 42. Each horizontal wall section 58 has a through-hole 59 each vertically aligned with the other hole 59 and configured to receive a portion of the slide post 40. More specifically, each slide post 40 is preferably connected with the associated base body 38 by inserting the upper end 40a of the post 40

through both of the openings 59, the post 40 being retained therein either by friction fit with the openings 59, by weldment material or by any other appropriate means. Further, the connective section 44 also includes a mounting tab 62 extending outwardly from the vertical wall section 60 and having a through-hole 63. The mounting tab through-hole 63 is configured to receive a portion of a vertical actuator 16 to connect the actuator 18 with the base 12, as discussed in further detail below.

[0026] Preferably, the base main section 42 and connective arm section 44 are integrally formed or connected, such that the base body 38 is generally of one-piece construction. Most preferably, each base body 38 is formed as a single cast block, but may alternatively be formed of two or more separately connected pieces, such as a plurality of attached plates or bars. Further, the base body 38 may be formed in any other appropriate manner, such as a solid block or a frame providing the main section 38, with separate bearings or brackets configured to mount the horizontal actuator(s) 18 and another bracket configured to connect with at least a vertical actuator 16 and preferably also with the main screed 3.

[0027] Referring again to Figs. 4-6 and 8, the slide post 40 of each base portion 20A, 20B is preferably formed as an elongated circular cylindrical bar 64 having an upper end 65 fixedly attached to the base body and a lower end 66 movably attached to the main screed 3. Specifically, the bar upper end 65 extends through the two holes 59 in the connective section 42 of the associated base body 38 and the bar lower end 66 is slidably disposed within a tubular bearing 35 of the main screed mounting portion 8. However, the slide posts 40 may each be alternatively fixedly or immovably attached to the main screed 3 and slidably disposed in a bearing opening(s) in the base body 38 (structure not shown). Further, the cylindrical bar 64 may have any other appropriate cross-sectional shape, such as for example ovular or rectangular, or the slide post 40 may be a multi-piece fixed or telescoping member (none shown). Further for example, the base portions 20A, 20B may each be constructed without a slide post 40 or any other member for directly connecting the base 12 with the main frame 3, such that the extension screed 10 is then connected to the main screed 3 merely by the two or more vertical actuators 16.

[0028] Furthermore, although the base 12 is preferably formed of two horizontally spaced-apart base portions 20A, 20B, the base 12 may be formed in any other appropriate manner. For example, the base 12 may be formed of two separate portions pivotally connected by a joint, linkage or other appropriate means to enable relative vertical displacement of the two base portions, such that the base 12 is "articulating" (structure not shown). Further for example, the base 12 may be formed of a single member, a truss, a box frame or another appropriate frame or assembly of members that is generally rigid and pivotally and/or displaceably connectable with the main screed 3 (none shown). Such a single piece base 12 may either be pivotally connected with the main screed 3 by appropriate means and having a single vertical actuator 16, such that the base 12 merely pivots relative to the main screed 3 but does not vertically displace (i.e., linearly) with respect thereto, may be slidably connected so as to vertically displace but unable to pivot, or may have a slidable pivot connection such that the base 12 is capable of vertically and pivotally displacing. The scope of the present invention includes these and all other appropriate structures of the base 12 that enable the extension screeds 10 to function generally in accordance with the appended claims.

[0029] Referring to Figs. 3-6 and 13-15, as discussed above, the extension screed assembly 10 includes two vertical actuators 16, specifically a first, inner actuator 17A preferably connected with the inner base portion 20A and a second, outer actuator 17B preferably connected with the outer base portion 20A. Preferably each vertical actuator 17A, 17B has a "movable" portion 68 attached to the associated portions 20A, 20B of the base 12 and a "fixed" portion 70 mounted to the main screed 3, i.e., so as to be immovable with respect to the main screed 3. The movable portions 68 are each vertically displaceable with respect to the fixed portion 70, and thus with respect to the main screed 3, along a vertical axis 69 so as to displace the extension screed 10 as described in detail below. Each movable portion 68 is preferably the rod 72 of a hydraulic cylinder 74, as discussed in further detail below, but may alternatively be the movable or "output" component of any other appropriate linear or rotary actuator, as discussed below. As a further alternative, the movable portions 68 (e.g., rods 72) may be attached to the main screed 3 and the fixed portions 70 (e.g., cylinders 74) may be mounted on the base 12, such that relative displacement of the movable portions 68 displaces the "fixed" portions 70 and thereby also displaces the base 12.

[0030] In any case, the two vertical actuators 17A, 17B preferably function to vertically displace and/or pivot the extension screed 10 relative to the main screed 3 in the following manner. When the two actuator movable portions 68 are each displaced a substantially equal vertical distance d_O with respect to the main screed 3, the base 12, and thus the carriage 14, is substantially linearly displaced vertically (i.e., without rotation) with respect to the main screed 3, as shown in Fig. 14. However, when the movable portion 68 of one of the two vertical actuators 16 is displaced a first vertical distance d_1 with respect to the main screed 3 (e.g., second actuator 17B) and the movable portion 68 of the other one of the two vertical actuators 16 is displaced a second, greater vertical distance d_2 with respect to the main screed 3 (e.g. first actuator 17A), the base 12 and carriage 14 are pivotally displaced with respect to the main screed 3 within a generally vertical plane P_v extending through the extension screed 10, as shown in Fig. 15. Alternatively, the base 12 also pivots within the plane P_v when one actuator movable portion 68 is held stationary while the other actuator movable portion 68 is displaced either upwardly or down-

wardly. In either case, pivotal displacement of the base 12 with respect to the main screed 3 adjusts a slope angle As between the associated extension screed plate working surface 11a and the proximal main screed plate working surface 4a.

[0031] As mentioned above, the two vertical actuators 16 are each preferably a linear actuator and most preferably a hydraulic cylinder 74 having a cylinder body 75 mounted to the main screed 3 and a displaceable (i.e., extendable and retractable) rod 72 attached to the base 12. More specifically, the cylinder body 75 is inserted through the upper and lower openings 37, 39, respectively, in one pair of bracket sections 32 of the mount 8 of one screed frame half 7, such that the lower end 75a of the body 75 rests against a horizontal wall 7c of the particular main screed frame half 7. Further, the free end 72a of the rod 72 is inserted through the opening 63 of the mounting tab 62 of one of the base portions 20A or 20B and retained therein by appropriate means, such as by a pin, so as to thereby connect the actuator 16 to the base 12. Further, the vertical actuators 16 are each fluidly connected with a source of hydraulic fluid, a pump and at least one control valve by means of a hydraulic circuit (none shown), each hydraulic component being mounted at an appropriate location on the extension screed 10 and/or the main screed 3.

[0032] However, as discussed above, it is within the scope of the present invention for the vertical actuators 16 to be provided by any other type of actuator capable of vertically displacing the base 12 with respect to the main screed 3. For example, the vertical actuators 16 may each be provided by a motor driven screw, a solenoid, a slider-crank mechanism, a rack-and-pinion mechanism, a three-bar or four-bar linkage mechanism, a pneumatic cylinder, a solenoid, etc, such that the actuator movable portion 68 is provided by the "nut" or other threaded hole component of a motor-screw actuator, the rack of a rack-and-pinion mechanism, the slider of a slider crank mechanism, the rod of a solenoid, etc. (none shown). Further for example, the extension screed 10 may include only a single vertical actuator 16 or may include three or more vertical actuators 16 (not shown). The present invention includes these and all other configurations of the vertical actuators 16 that enable the extension screed 10 to function generally as described herein.

[0033] Referring now to Figs. 3-6 and 9, as discussed above, the carriage 14 preferably includes first and second sections 22 and 24, respectively, specifically the inner rectangular frame 26 disposed about the base 12 and the outer rectangular frame 28 disposed at least partially about the inner frame 26. Preferably, the extension screed 10 further comprises at least one and most preferably two first elongated guide members 76 movably connecting the first carriage section 22 with the base 12 and at least one and most preferably two second guide members 78 movably connecting the second carriage section 24 with the first carriage section 22 (and with the base 12). Each first guide member 76 is attached to the inner frame 26 and is slidably connected with the base 12, such that the guide members 76 linearly displace with respect to the preferred base portions 20A, 20B when the first horizontal actuator 19 moves the first carriage section 22, as discussed in further detail below. Preferably, the first guide members 76 each include an elongated tubular body 77 having opposing ends 77a, 77b attached to facing inner surfaces 26a, 26b of the inner frame 26, as discussed below, and extending through one pair of the aligned bearing openings 48A or 48B in the base portions 20A, 20B, preferably provided by the central bore of a separate one of the spherical bearings 50. When the first carriage section 22 is displaced with respect to the base 12, the tubular bodies 77 slidably displace through the two base portions 20A, 20B, thereby guiding the horizontal linear displacement of the entire carriage 14 with respect to the base 12. In addition, by being disposed in the spherical bearings 50, the tubular bodies 77 are pivotable with respect to the base portions 20A, 20B, which are restricted to vertical displacement by the slide posts 40, thereby enabling the first frame 26 (and thus the entire carriage 14), to pivot about the base 12.

[0034] Further, each of the second guide members 78 is attached to the outer frame 28 and is movably connected with a separate one of the first guide members 76, such that each guide member 78 linearly displaces with respect to the connected first guide member 76 when the second horizontal actuator 21 moves the second carriage section 24, as described in detail below. Preferably, the second guide members 78 each include an elongated post 79 slidably disposed at least partially within the tubular body 77 of the associated first guide member 78 and having a free end 79a attached the outer frame 28. When the outer frame 28 is displaced with respect to the inner frame 26, the two guide posts 79 each telescopingly displace with respect to the tubular body 77 of the connected first guide member 76, to thereby guide the horizontal linear displacement of the second carriage section 24 with respect to the base 12.

[0035] Although the extension screed 10 of the present invention preferably includes the two guide members 76, 78, and preferably a pair of each of the two types of guide members 76 and 78, the carriage 14 may alternatively include only a single member 78 and a single second guide member 78 connected therewith or three or more pairs of first and second guide members 76 and 78. Further, the carriage 14 may be alternatively constructed without any guide members 76 or 78 and be guided by portions of the inner frame 26 and/or outer frame 28.

[0036] Referring to Figs. 4-6, 9 and 13-15, the first or inner frame 26 is preferably formed as a generally rectangular box 80 having an open rear end 80a and defining or bounding the generally hollow interior space S_1 of the frame 26 (discussed above). The first frame interior space S_1 is sized to contain the preferred two base portions 20A, 20B, the first guide members 78, the first hor-

izontal actuator 19 and a major portion of the second horizontal actuator 21, as discussed above and in further detail below. Preferably, the first frame box 80 includes five wall sections or walls: top and bottom walls 81 and 82, respectively, inner and outer side walls 83 and 84, respectively, and a front wall 85. The top and bottom walls 81 and 82 each extend generally horizontally and generally parallel with the other wall 82 or 81 and each has an outer surface 81a, 82a, respectively, slidably contactable with portions of the outer frame 28. As such, the two walls 81 and 82 each function as a separate one of a pair of rails 87 for supporting telescoping movement of the outer frame 28 with respect to the inner frame 26, as discussed above and in further detail below.

[0037] Further, the front wall 85 extends generally vertically between the front edges (not indicated) of the top and bottom walls 81, 82 and generally horizontally between the front edges (not indicated) of the two side walls 83, 84. The front wall 85 functions to cover or enclose the open rear end 80a of the frame box 80 and to connect the top and bottom walls 81 and 82. Preferably, the top wall 81, the bottom wall 82 and the front wall 85 are all provided by a single, generally C-shaped plate 88 that further includes two vertical lips 89 extending from inwardly from the rear edges of the top and bottom walls 81, 82, respectively. However, the preferred inner frame box 80 may alternatively be constructed of three separate plates each providing one of the walls 81, 82, and 83 or the box 80 may be formed without a front wall 85 and having two separate plates, bars, etc., providing the top and bottom walls 81 and 82 (neither alternative shown).

[0038] Further, the inner and outer side walls 83 and 84, respectively, each extend generally vertically and generally parallel with the other side wall 85, 84, respectively, and also generally perpendicular with respect to the top and bottom walls 81 and 82 and with respect to the front wall 85. Each side wall 83 and 84 is preferably formed as a generally flat, generally rectangular plate 90 and are each attached to the C-shaped plate 88 proximal to a separate side edge 88a, 88b thereof. The two side walls 84, 85 are configured to support portions of the two preferred horizontal actuators 19 and 21 and the two preferred first guide members 76, as described below.

[0039] Preferably, each side wall plate 90 includes two generally tubular support collars 92 each disposed in a separate one of two vertically-spaced circular openings 94 and sized to receive a tubular end 77a of one of the first guide members 76. The support collars 92 in each side wall 83, 84 are each generally aligned with one collar 92 in the other side wall 84, 83, respectively, such that each horizontally-spaced pair of aligned collars 92 support one of the two first guide members 76, and thereby connects the member 76 with the first frame 26. Further, the inner side wall 83 includes a circular mounting plate 96 disposed generally between the two collars 92 configured to attach a rod end 158a of the preferred first horizontal actuator 19 (as discussed below) to the inner frame 26. More specifically, the plate 96 has an inner surface 96a against which the first actuator rod end 158a is abutted and a through-hole 97 sized to permit insertion of threaded fastener (not indicated) through the plate 96 so as to engage with a threaded hole (not indicated) in the rod 158, and thereby removably connect the first actuator 19 to the first frame 26 of the carriage 14. Additionally, the inner side wall plate 90 also has a plurality of mounting holes 98 located proximal to the attachment plate 96 sized and arranged to enable a base end 157a of the preferred second actuator 21 (described below) to be attached to the first frame 26 by means of threaded fasteners (not indicated) inserted through the holes 98. Furthermore, the outer side wall 84 includes an annular bearing plate 99 disposed generally between the two collars 92 of the side wall 84 and having a bearing opening 99a sized to receive and slidably support a rod 159 of the preferred second horizontal actuator 21, as discussed below. Thus, the second horizontal actuator 21 extends generally between the two side walls 83, 84 of the inner frame 26 and into the outer frame 28.

[0040] Still referring now to Figs. 3-6, 9 and 13-15, the second or outer frame 28 of the second carriage section 24 preferably includes an upper, carrier subframe 27 slidably connected with the first, inner frame 26 and a lower, screed support subframe 29 attached to the carrier subframe 29. The carrier subframe 27 is preferably formed as a generally rectangular box 100 having an open rear end 100a and an open inner side end 100b, the box 100 bounding the second frame interior space S_2, as mentioned above. The second frame box 100 is sized larger than the first frame box 80 such that the first, inner frame 26 is receivable within the second frame interior space S_2. With this structure, the outer frame 28 linearly displaces with respect to the inner frame 26 by slidably displacing about the inner frame box 80 along the axis 25 such that greater or lesser portions, depending on the direction of the displacement, of the inner frame 26 are disposed within the second frame interior space S_2, as described in further detail below. Preferably, the outer frame box 100 includes four wall sections or walls: top and bottom walls 101, 102, respectively, an outer side wall 104 and a front wall 105.

[0041] Preferably, the top and bottom walls 101 and 102 each extend generally horizontally and generally parallel with the other wall 102, 101 and are spaced apart by a greater vertical distance (not indicated) than the vertical spacing distance (not indicated) between the top and bottom walls 81, 82 of the inner frame box 80. The top and bottom walls 101, 102 each have an inner contact surface 106 slidably contactable with the outer surfaces 81a, 82a of the top and bottom walls 81, 82, respectively, of the inner frame 26. As such, the two walls 101, 102 function as slide members 107 that slidably displace against the rail members 87 of the inner frame 26 when the second carriage section outer frame 28 displaces with respect to the first carriage section inner frame 26 (and with respect to the base 12). By having the outer frame upper wall 102 disposed generally upon the inner frame

upper wall 82, the inner frame 26 preferably at least partially supports the weight of the second carriage section 26. Preferably, the contact surfaces 106 of the outer frame top and bottom walls 101 and 102 are provided by a separate bearing pad 111 attached to the wall inner surfaces 101a, 102a, but may alternatively by provided directly by the wall inner surfaces 101a, 102a. Further, the bottom wall outer of lower surface 102b is configured to attach the screed plate subframe 29 to the carrier subframe 27, preferably through various components (hydraulic cylinders, adjusting screws, etc. - none shown) for pivoting the screed plate subframe 29 with respect to the carrier subframe 27, and thereby to the carriage 14, as described in further detail below.

[0042] Furthermore, the front wall 105 extends generally vertically between the front edges (not indicated) of the top and bottom walls 101, 102 and generally horizontally between the box open side end 100b and the front edge 104a of the outer side wall 104. The front wall 105 functions to cover or enclose the front end of the frame box 100 and to connect the top and bottom walls 101 and 102. Preferably, the top wall 101, the bottom wall 102 and the front wall 105 are all provided by a single, generally C-shaped plate 108 that further includes two vertical lips 109 extending from inwardly from the rear edges of the top and bottom walls 101, 102, respectively. However, the preferred outer frame box 100 may alternatively be constructed of three separate plates each providing one of the walls 101, 102, and 105 or the box 100 may be formed without a front wall 105 and having two separate plates, bars, etc., providing the top and bottom walls 101, 102 (neither alternative shown).

[0043] Further, the outer side wall 104 extends generally vertically and generally parallel with the outer side or end wall 85 of the inner frame 26 (i.e., when the frames 26 and 28 are assembled together) and also extends generally perpendicularly with respect to the top and bottom walls 101 and 102 and with respect to the front wall 105. The side wall 104 is preferably formed as a generally flat, generally rectangular plate 112 attached to the C-shaped plate 108 proximal to the plate outer side edge 108a. The side wall 104 is configured to support a portion of the preferred second horizontal actuator 21 and the two preferred second guide members 78. Preferably, the side wall 104 includes two generally circular mounting flanges 114 each disposed in a separate one of two vertically-spaced circular openings 116 in the plate 112 and configured to attach a separate one of the two second guide members 78 to the outer frame 28. More specifically, each mounting flange 114 has a plurality of spaced apart holes (not indicated) through each which is inserted a threaded fastener (not indicated) engageable with the free end of the guide posts 79 to attach the two guide posts 79 to the outer frame 28. Further, the outer side wall 104 includes a circular mounting plate 120 disposed generally between the two mounting flanges 114 and configured to attach a rod end 159a of the preferred second horizontal actuator 21 (as discussed below) to the inner outer frame 26. More specifically, the mounting plate 120 has an inner surface 120a against which the second actuator rod end 159a is abutted and a through-hole 121 sized to permit insertion of threaded fastener (not indicated) through the plate 120 so as to engage with a threaded hole (not indicated) in the rod 159, and thereby removably connect the second actuator 21 to the outer frame 28 of the carriage 14.

[0044] Furthermore, the screed support subframe 29 is preferably formed as an elongated, generally rectangular box 124 having a lower mounting surface 125 configured to support a screed plate 11. Preferably, the subframe box 124 includes a generally horizontal bottom wall 128, generally vertical and parallel front and rear walls 130, 132, respectively, and generally vertical and parallel inner and outer side walls 134, 136, respectively. The screed support subframe 29 is preferably attached to the carrier subframe 27, specifically to the bottom wall 102, by at least at least one hinge and at least one actuator (neither shown) for pivoting the subframe 29 and screed plate 11 relative to the remainder of the carriage 14, but may alternatively be fixedly connected to the carrier subframe by any appropriate means. The bottom wall 128 has a lower surface 128a against which the upper surface of the screed plate 11 is disposeable, such that the screed plate 11 is mountable to the carriage 14 by a plurality of threaded posts (not shown) of the screed plate 11 being inserted through a plurality of corresponding openings (not shown) in the bottom wall 128. The subframe front wall 126 is configured to attach a strike-off plate 140 to the carriage 14 and functions to prevent paving material from depositing on the upper surface 128b of the bottom wall 128. Although the subframe 29 is preferably formed as described above, the subframe may be formed in any other appropriate manner, such as a rectangular box having open front and rear ends, or the carriage 14 may be constructed without a support subframe and with the screed plate 11 being directly mounted to the outer frame 28 or connected to the outer frame 28 by appropriate means, such as one or more mounting brackets or mounting spacer plates (no alternatives shown).

[0045] Further, although the carriage 14 is preferably formed of two sections 22, 24 that include inner and outer frames 26, 28, respectively, it is within the scope of the present invention to construct the carriage 14 in any other appropriate manner. For example, the inner and outer carriage sections 22, 24 may each be formed with an appropriate structure other than as a rectangular box frame as described above, such as a skeletal truss, a single "backboard" member or plate, a solid bar or beam, etc., of any appropriate shape (no alternatives shown). Further for example, the carriage 14 may include only a single section (i.e., as opposed to inner and outer sections) of any appropriate construction, connectable with the base 12 and configured to support the screed plate 11. The scope of the present invention encompasses these and all other appropriate structures of the carriage 14 capable of supporting the screed plate 11 and ena-

bling the extension screed 10 to function generally as described herein.

[0046] Referring now to Figs. 3-6 and 10-15, the two horizontal actuators 18 each preferably include a first, fixed portion 150, preferably connected with the base 12 and a second, movable portion 152 connected with either the first carriage section 22 or the second carriage section 24 and displaceably connected with the fixed portion 150. As such, displacement of each actuator movable portion 152 with respect to the corresponding actuator fixed portion 150 displaces the carriage section 22 or 24 with respect to the base portion 12. Preferably, each one of the first and second actuators 19 and 21, respectively, is a hydraulic cylinder 154, 155, respectively, that includes a cylinder body 156, 157 and a piston rod 158, 159, respectively, disposed at least partially within the respective cylinder body 156 and 157. The piston rods 158 and 159 are displaceable, i.e., extendable or retractable, with respect to the connected body 156, 157 along a separate cylinder axis 160, 161, respectively, so as to displace the connected frame 26, 28, respectively, as discussed above and in further detail below. Further, the horizontal actuators 18 are each fluidly connected with a source of hydraulic fluid, a pump and at least one control valve by means of a hydraulic circuit (none shown), each hydraulic component being mounted at an appropriate locations on the extension screed 10 or on the main screed 3.

[0047] Preferably, the cylinder body 156 of the first horizontal actuator 19 has a base end 156a disposed within the central through-hole 54 of the outer base portion 20B and pivotally attached therewithin by the pin 56 as described above. The actuator body 156 extends from the outer base portion 20B and into the central through-hole 54 of the inner base portion 20A and the actuator rod 158 extends to the inner side wall 83 of the inner frame 26 and is attached to the mounting plate 96 described above. Further, the second actuator body 157 has a base end 157a attached the inner frame inner side wall 83, preferably by fasteners inserted through the mounting holes 98, and an inner end 157b is disposed against the bearing plate 99, the second actuator body 157 being spaced vertically generally below the first actuator body 156. The second actuator rod 159 extends through the bearing plate 99, horizontally across the second frame interior space S_2 and has an outer end 159a attached to the mounting plate 120 on the outer frame outer side wall 105 as described above. Preferably, the first and second horizontal actuators 19 and 21 are spaced apart vertically such that the two rod axes 160 and 161 are generally disposed in a common vertical plane, preferably plane P_V as discussed above and depicted in Fig. 15.

[0048] Although the two horizontal actuators 18 are preferably hydraulic cylinders 154, 155, either or both of the first and second actuators 19 and 21 may be provided by any other type of actuator capable of horizontally displacing the carriage 14 with respect to the base 12, and thus the main screed 3. For example, the horizontal actuators 18 may each be provided by a motor driven screw, a solenoid, a slider-crank mechanism, by a rack-and-pinion mechanism, a three-bar or four-bar linkage mechanism, a pneumatic,cylinder, a solenoid, etc, such that the actuator movable portion 152 is provided by the "nut" or other threaded hole component of a motor-screw actuator, the rack of a rack-and-pinion mechanism, the slider of a slider crank mechanism, the rod of a solenoid, etc. Further for example, the extension screed 10 may include only a single horizontal actuator 18, such as if the carriage 14 included only a single frame (not shown), or may include three or more horizontal actuators 18. The present invention includes these and all other configurations of the horizontal actuators 18 that enable the extension screed 10 to function generally as described herein.

[0049] Referring to Figs. 10-15, the preferred horizontal actuators 19, 21 function to displace the first and second carriage sections 22, 24, respectively, generally in the following manner. When the first and second frames 26, 28 are each located in inner, "retracted" positions with respect to the main screed 3 (e.g., Figs. 10 and 13), the rod 159 of the second horizontal actuator 21 is extendable outwardly along the rod axis 161 so as to push the second frame 28, and thus the screed plate 11, to displace with respect to the first frame 26 in the outward horizontal direction H_O and generally away from the screed centerline 1a. As discussed above, such movement of the second actuator 21 moves the carriage outer end 14a from the first horizontal or lateral position P_1 to the second lateral position P_2, or to an intermediate position located therebetween (none indicated), so as to thereby increase the overall effective width of the screed assembly, and thus the width of a mat of paving material formed by the screed assembly 1. To further increase the overall effective width W of the screed assembly 1, the rod 158 of the first horizontal actuator 19 is retractable along the rod axis 160 so as to pull the first frame 28, and thus also the second frame 28 and thereby screed plate 11, to displace with respect to the first base 12 in the outward horizontal direction H_O and generally away from the screed centerline 1a. As is also described above, such movement of the first actuator 19 moves the carriage outer end 14a from the second position P_2 to the third lateral position P_3, or to an intermediate position located therebetween (none indicated). Alternatively, the extension screed 10 may be extended by first using the first horizontal actuator 19 to displace the entire carriage 14 outwardly and then using the second horizontal actuator 21 to displace the second carriage section 24 outwardly, each separate movement being implemented as described above.

[0050] To retract the extension screed 10 from the outermost or extended position, the first horizontal actuator 19 is extendable along the rod axis 160 so as to push the first frame 26 (and thus second frame 28) to displace in the inward horizontal direction H_I and generally toward the screed centerline 1a. Thereafter, the second horizontal actuator 21 is retractable along the rod axis 161 so as to pull the second frame 28 to displace in the inward

horizontal direction H_I and generally toward the screed centerline 1a, such that the carriage outer end 14a is located proximal to the outer end of the main screed 3. Alternatively, the extension screed 10 may be retracted by first using the second horizontal actuator 21 to displace the second carriage section 24 inwardly and then using the first horizontal actuator 19 to displace the entire carriage 14 inwardly, each separate movement being implemented as described above. Further, when the extension screed 10 is in an extended position, the vertical actuators 16 may be used to pivot or slope the extension screed 10 with respect to the main screed 3, and thereby adjust the angle As between the extension screed plate working surface 11a with respect to the main screed plate working surface 4a, in the manner described above and depicted in Fig. 15. The two carriage frames 26 and 28 each displace along a common axis 25.

[0051] Referring to Figs. 1-3, the extension screed assembly 10 preferably further includes a control system 160 configured to automatically operate the one or more vertical actuators 16 and the one or more horizontal actuators 18 so as to automatically and remotely position the extension screed 10 relative to the main screed 1. The control system 160 includes a controller 162, preferably located in the operator station 9 on the main screed 3, a plurality of control valves (none shown) each controlling hydraulic flow into a separate one of the preferred hydraulic actuators 17A, 17B, 19 and 21 and one or more position sensors (none shown) configured to determine the actual position of the actuator rods 72, 158 and 159 or the frames 26, 28. The control system 160 enables a screed operator to automatically linearly displace and/or pivotally displace the base 12 and/or the carriage 14, and thereby also displace the extension screed plate 11, to a desired position with respect to the main screed 3.

[0052] In summary, constructions disclosed herein include but are not limited to:

1. An extension screed for a screed assembly of a paving vehicle, the screed assembly including a main screed, the extension screed comprising: a base movably connectable with the main screed; a vertical actuator connectable with the main screed and configured to linearly displace the base with respect to the main screed in opposing, generally vertical directions; a carriage movably connected with the base and configured to support a screed plate; and a horizontal actuator connected with the base and configured to linearly displace the carriage with respect to the base in opposing, generally horizontal directions.

2. The extension screed as recited in item 1 wherein the main screed includes a screed plate and the extension screed further comprises a screed plate mounted to the carriage such that when the base and vertical actuator are connected with the main screed, the vertical actuator is configured to displace the base so as to adjust an elevational position of the extension screed plate with respect to the main screed plate and the horizontal actuator is configured to displace the carriage so as to adjust a horizontal position of the extension screed plate with respect to the main screed plate.

3. The extension screed as recited in item 2 wherein each one of the main and extension screed plates has a lower horizontal working surface and the vertical actuator is configured to pivot the base with respect to main screed so as to adjust a slope angle between the extension screed plate surface and the main screed plate surface.

4. The extension screed as recited in item 1 wherein: the carriage includes a first section movably connected with the base and a second section movably connected with at least one of the first section and the base, the horizontal actuator being a first horizontal actuator and configured to linearly displace the first carriage section with respect to the base; and the extension screed further comprises a second horizontal actuator configured to displace the second carriage section with respect to the first carriage section in opposing, generally horizontal directions.

5. The extension screed as recited in item 4 wherein: the main screed has a longitudinal centerline extending generally in a direction of paving vehicle travel and the second carriage section provides a carriage outer end spaced laterally from the centerline; the second horizontal actuator is configured to displace the second carriage section such that the carriage outer end moves between a first horizontal position at which the carriage outer end is spaced a first perpendicular distance from the centerline and a second horizontal position at which the carriage lateral end is spaced a second perpendicular distance from the centerline, the second distance being greater than the first distance; and the first horizontal actuator is configured to displace the first carriage section such that the carriage outer end moves between the second horizontal position and a third horizontal position at which the carriage outer end is spaced a third perpendicular distance from the centerline, the third distance being greater than the second distance.

6. The extension screed as recited in item 5 wherein the main screed has a lateral outer end spaced a fourth perpendicular distance from the centerline and at least the second and third distances are each greater than the fourth distance such that the extension screed extends laterally outwardly from the main screed when the carriage outer end is disposed in one of the second horizontal position and the third horizontal position.

7. The extension screed as recited in item 4 wherein the second carriage section is disposed at least partially about the first carriage section such that the second horizontal actuator is configured to telescopingly displace the second carriage section with respect to the first carriage section.

8. The extension screed as recited in item 4 wherein the main screed has a longitudinal centerline extending in a direction of paving vehicle travel, the extension screed has a central axis extending through the base and the carriage and generally perpendicularly with respect to the centerline, the first actuator is configured to displace the carriage generally along the central axis and the second horizontal actuator is configured to displace the second carriage section generally along the central axis.

9. The extension screed as recited in item 4 further comprising: a first elongated guide member attached to the first carriage section and slidably connected with the base so as to movably connect the first carriage section with the base, the first guide member linearly displacing with respect to the base when the first horizontal actuator moves the first carriage section; and a second elongated guide member attached to the second carriage section and movably connected with the first guide member so as to movably connect the second carriage section with the first carriage section, the second guide member linearly displacing with respect to the first guide member when the second horizontal actuator moves the second carriage section.

10. The extension screed as recited in item 9 wherein the base includes a bearing opening and the first guide member is slidably disposed within the base bearing opening.

11. The extension screed as recited in item 9 wherein one of the first and second guide members includes an elongated tubular body and the other one of the first and second guide members includes an elongated post slidably disposed at least partially within the tubular body such that the post telescopingly displaces with respect to the tubular body when the second carriage section displaces with respect to the first carriage section.

12. The extension screed as recited in item 4 wherein the first carriage section includes a rail member and the second carriage section includes a slide member slidably disposed upon the rail member such that the first carriage section at least partially supports the weight of the second carriage section and the slide member displaces upon the rail when the second carriage section displaces with respect to the base.

13. The extension screed as recited in item 4 wherein the first and second horizontal actuators each have a central axis, the first carriage section is displaceable along the first actuator axis and the second carriage section is displaceable along the second actuator axis, the two actuators being spaced apart vertically such that the two axes are generally disposed in a common vertical plane.

14. The extension screed as recited in item 4 wherein the main screed includes a longitudinal centerline extending generally in a direction of paver travel, the first carriage section has an inner lateral end and the first horizontal actuator is a hydraulic cylinder having a displaceable rod, the first cylinder rod being attached to the carriage inner lateral end such that retraction of the rod displaces the carriage generally away from the centerline and extension of the rod displaces the carriage generally toward the centerline.

15. The extension screed as recited in item 4 wherein: the first carriage section includes a first frame, the first frame at least partially bounding an interior space, the base being disposed within the first frame interior space; and the second carriage section includes a second frame, the second frame at least partially bounding an interior space, the first frame being disposeable at least partially within the second, frame interior space such that the second carriage section is displaceable about the first carriage section.

16. The extension screed as recited in item 4 wherein the base includes a first body and a second body spaced horizontally from the first body, the first and second horizontal actuators each extending between and being connected with each one of the two base bodies.

17. The extension screed as recited in item 1 wherein the vertical actuator is a first vertical actuator and the extension screed further comprises a second vertical actuator connectable with the main screed so as to be horizontally spaced from the first actuator, the second actuator being connected with the base and configured to displace the base with respect to the main screed in generally vertical directions.

18. The extension screed as recited in item 17 wherein each one of the first and second vertical actuators has a movable portion attached to the base and is vertically displaceable with respect to the main screed such that when the two actuator movable portions are each displaced a substantially equal vertical distance with respect to the main screed, the base is linearly displaced vertically with respect to the main screed.

19. The extension screed as recited in item 18 wherein when the movable portion of one of the two vertical actuators is displaced a first vertical distance with respect to the main screed and the movable portion of the other one of the two vertical actuators is displaced a second, greater vertical distance with respect to the main screed, the base is pivotally displaced with respect to the main screed within a generally vertical plane.

20. The extension screed as recited in item 19 wherein the main screed includes a screed plate with a generally horizontal working surface and the extension screed further comprises a screed plate mounted to the carriage and having a generally horizontal working surface, such that pivotal displacement of the base with respect to the main screed adjusts a slope angle between the main screed working sur-

face and the extension screed working surface.

21. The extension screed as recited in item 1 wherein the base includes a first portion and a second portion, the two base portions being spaced apart horizontally with respect to the main screed, the vertical actuator being a first vertical actuator and connected with the base first portion, and the extension screed further comprises a second vertical actuator connectable with the main screed, connected with the base second portion and configured to displace the base second portion with respect to the main screed in generally vertical directions.

22. The extension screed as recited in item 21 wherein: when the two base portions are each displaced a substantially equal distance with respect to the main screed, the carriage is linearly displaced vertically with respect to the main screed; and when one of the two base portions is displaced a first vertical distance with respect to the main screed and the other one of the two base portions is displaced a second, greater vertical distance with respect to the main screed, the carriage is pivotally displaced with respect the main screed within a generally vertically plane.

23. The extension screed as recited in item 21 wherein the main screed has a generally horizontal surface and when one of the two base portions is displaced to a first vertical position spaced a first vertical distance from the main screed surface while the other one of the two base portions is located at a second vertical position spaced a second vertical distance from the main screed surface, the first distance being greater than the second position, the carriage is pivotally displaced with respect to the main screed within a generally vertical plane.

24. The extension screed as recited in item 21 wherein the main screed includes two horizontally spaced apart mounting bearings and each one of the first and second base portions includes a post, each one of the two base portion posts being slidably disposed within a separate one of the two mounting bearings to displaceably connect the base with the main screed.

25. The extension screed as recite in item 21 wherein each one of the first and second base portions has a bearing opening and the extension screed further comprises an elongated guide member extending through each one of the two base bearing openings and having opposing ends attached to the carriage so as to connect the carriage with the base, the guide member being configured to slidably displace through the two base bearing openings when the horizontal actuator displaces the carriage with respect to the base.

26. The extension screed as recited in item 1 wherein the main screed includes a longitudinal centerline extending generally in a direction of paving vehicle travel and the carriage has an outer lateral end, the horizontal actuator being configured to displace the carriage such that the carriage outer end is movable between a first, most proximal position with respect to the main screed centerline and a second most distal position with respect to the main screed.

27. The extension screed as recited in item 1 wherein the main screed includes a mounting bearing and the base includes a post slidably disposed within the mounting bearing to displaceably connect the base with the main screed.

28. The extension screed as recited in item 1 wherein the base includes two base portions spaced apart horizontally, each base portion being displaceably connected with the main screed and connected with the carriage.

29. The extension screed as recited in item 1 wherein the carriage includes a first, inner carriage section disposed about the base and a second, outer carriage section slidably disposed at least partially about the inner carriage section and displaceable with respect to the first carriage section.

30. An extension screed for a main screed of a paving vehicle, the extension screed comprising: a first frame movably connectable with the main screed; a vertical actuator connectable with the main screed and configured to displace the first frame in generally vertical directions with respect to the main screed; a first horizontal actuator configured to displace the first frame in generally horizontal directions with respect to the main screed; a second frame movably connected with the first frame and configured to support a screed plate; and a second horizontal actuator configured to displace the second frame with respect to the first frame in generally horizontal directions.

31. The extension screed as recited in item 30 further comprising a base disposed within and connected with the first frame, the vertical actuator being connected with the base and configured to vertically displace the base so as to vertically displace the first and second frames.

32. An extension screed for a main screed of a paving vehicle, the extension screed comprising: two base members, each base member being movably connectable with the main screed; two vertical actuators each connectable with the main screed and connected with a separate one of the two base members, each vertical actuator being configured to linearly displace the connected base member with respect to the main screed in opposing, generally vertical directions; and a carriage configured to support a screed plate and connected with each one of the two base members such that the two actuators are configured to displace the carriage with respect to the main screed in opposing, generally vertical directions and to alternatively pivot the carriage with respect to the main screed within a generally vertical plane.

[0053] It will be appreciated by those skilled in the art that changes could be made to the constructions described above. It is understood that this invention is not limited to the particular embodiments disclosed, but it is intended to cover modifications within the scope of the present invention as defined in the appended claims.

Claims

1. An extension screed (10) for a screed assembly (1) of a paving vehicle (2), the screed assembly (1) including a main screed (3), the extension screed (10) comprising:

a base (12, 20A, 20B, 38) movably connectable with the main screed (3);
a vertical actuator (16, 17A, 17B) connectable with the main screed (3) and configured to linearly displace the base (12, 20A, 20B, 38) with respect to the main screed (3) in opposing, generally vertical directions;
a carriage (14) movably connected with the base (12, 20A, 20B, 38) and configured to support a screed plate (11), the carriage (14) including a first section (22) movably connected with the base (12, 20A, 20B, 38) and a second section (24) movably connected with the first section (22), the first carriage section (22) including a first frame (26) at least partially bounding an interior space (S_1), the base (12, 20A, 20B, 38) being disposed within the first frame interior space (S_1), and the second carriage section (24) including a second frame (28) at least partially bounding an interior space (S_2), the first frame (26) being disposeable at least partially within the second frame interior space (S_2) such that the second carriage section (24) is telescopingly displaceable with respect to the first carriage section (22);
a first horizontal actuator (19) having a central axis (160) and being connected with the base (12, 20A, 20B, 38) and configured to linearly displace the first carriage section (22) with respect to the base (12, 20A, 20B, 38) in opposing, generally horizontal directions (H_1, H_2) along the first actuator central axis (160); and
a second horizontal actuator (21) having a central axis (161) and being configured to displace the second carriage section (24) with respect to the first carriage section (22) in opposing, generally horizontal directions (H_1, H_2) along the second actuator central axis (161), and

wherein the first and second horizontal actuators (19, 21) are spaced apart vertically such that the first and second actuator axes (160, 161) are generally disposed in a common vertical plane (P_v).

2. The extension screed (10) of claim 1 wherein:

the main screed (3) has a longitudinal centerline (1a) extending generally in a direction of paving vehicle travel and the second carriage section (24) provides a carriage outer end (14a) spaced laterally from the centerline (1a);
the second horizontal actuator (21) is configured to displace the second carriage section (24) such that the carriage outer end (14a) moves between a first horizontal position (P_1) at which the carriage outer end (14a) is spaced a first perpendicular distance (D_1) from the centerline (1a) and a second horizontal position (P_2) at which the carriage lateral end (14a) is spaced a second perpendicular distance (D_2) from the centerline (1a), the second distance (D_2) being greater than the first distance (D_1); and
the first horizontal actuator (19) is configured to displace the first carriage section (22) such that the carriage outer end (14a) moves between the second horizontal position (P_2) and a third horizontal position (P_3) at which the carriage outer end (14a) is spaced a third perpendicular distance (D_3) from the centerline (1a), the third distance (D_3) being greater than the second distance (D_2).

3. The extension screed (10) as recited in claim 2 wherein the main screed (3) has a lateral outer end (3a) spaced a fourth perpendicular distance (D_4) from the centerline (1a) and at least the second and third distances (D_2, D_3) are each greater than the fourth distance (D_4) such that the extension screed (10) extends laterally outwardly from the main screed (3) when the carriage outer end (14a) is disposed in one of the second horizontal position (P_2) and the third horizontal position (P_3).

4. The extension screed (10) as recited in any preceding claim wherein the main screed (3) has a longitudinal centerline (1a) extending in a direction of paving vehicle travel, the extension screed (10) has a central axis (25) extending through the base (12, 20A, 20B, 38) and the carriage (14) and generally perpendicularly with respect to the centerline (1a), the first horizontal actuator (19) is configured to displace the carriage (14) generally along the central axis (25) and the second horizontal actuator (21) is configured to displace the second carriage section (24) generally along the central axis (25).

5. The extension screed (10) as recited in any preceding claim further comprising:

a first elongated guide member (76) attached to the first carriage section (22) and slidably connected with the base (12, 20A, 20B, 38) so as

to movably connect the first carriage section (22) with the base (12, 20A, 20B, 38), the first guide member (76) being adapted to linearly displace with respect to the base (12, 20A, 20B, 38) when the first horizontal actuator (19) moves the first carriage section (22); and

a second elongated guide member (78) attached to the second carriage section (24) and movably connected with the first guide member (76) so as to movably connect the second carriage section (24) with the first carriage section (22), the second guide member (78) being adapted to linearly displace with respect to the first guide member (76) when the second horizontal actuator (21) moves the second carriage section (24).

6. The extension screed (10) as recited in claim 5 wherein the base (12, 20A, 20B, 38) includes a bearing opening (48A, 48B) and the first guide member (76) is slidably disposed within the base bearing opening (48A, 48B).

7. The extension screed (10) as recited in claim 5 or 6 wherein one of the first and second guide members (76, 78) includes an elongated tubular body (77) and the other one of the first and second guide members (76, 78) includes an elongated post (79) slidably disposed at least partially within the tubular body (77) such that the post (79) is adapted to telescopingly displace with respect to the tubular body (77) when the second carriage section (24) displaces with respect to the first carriage section (22).

8. The extension screed (10) as recited in any preceding claim wherein the first carriage section (22) includes a rail member (87) and the second carriage section (24) includes a slide member (107) slidably disposed upon the rail member (87) such that the first carriage section (22) at least partially supports the weight of the second carriage section (24) and the slide member (107) displaces upon the rail (87) when the second carriage section (24) displaces with respect to the base (12, 20A, 20B, 38).

9. The extension screed (10) as recited in any preceding claim wherein the main screed (3) includes a longitudinal centerline (1a) extending generally in a direction of paver travel, the first carriage section (22) has an inner lateral end (83) and the first horizontal actuator (19) comprises a hydraulic cylinder (154) having a displaceable rod (158), the first cylinder rod (158) being attached to the carriage inner lateral end (83) such that retraction of the rod (158) is adapted to displace the carriage (14) generally away from the centerline (1a) and extension of the rod (158) is adapted to displace the carriage (14) generally toward the centerline (1a).

10. The extension screed (10) as recited in any preceding claim wherein the base (12, 20A, 20B, 38) includes a first body (20A) and a second body (20B) spaced horizontally from the first body (20A), the first and second horizontal actuators (19, 21) each extending between and being connected with each one of the two base bodies (20A, 20B).

Patentansprüche

1. Ausziehbohle (10) für eine Abgleichbohlenanordnung (1) für ein Straßenfertigungsfahrzeug (2), wobei die Abgleichbohlenanordnung (1) eine Hauptabgleichbohle (3) aufweist, mit

einer Basis (12, 20A, 20B, 38), die beweglich mit der Hauptabgleichbohle (3) verbindbar ist,

einem vertikalen Stellglied (16, 17A, 17B), das mit der Hauptabgleichbohle (3) verbindbar ist und zum linearen Verstellen der Basis (12, 20A, 20B, 38) bezüglich der Hauptabgleichbohle (3) in entgegengesetzten, allgemein vertikalen Richtungen ausgebildet ist,

einem Schlitten (14), der beweglich mit der Basis (12, 20A, 20B, 38) verbunden und zum Tragen einer Bohlenplatte (11) ausgebildet ist, wobei der Schlitten (14) einen ersten Abschnitt (22), der beweglich mit der Basis (12, 20A, 20B, 38) verbunden ist, einen zweiten Abschnitt (24), der beweglich mit dem ersten Abschnitt (22) verbunden ist, aufweist und der erste Schlittenabschnitt (22) einen ersten Rahmen (26) aufweist, der zumindest teilweise einen inneren Raum (S_1) abgrenzt, wobei die Basis (12, 20A, 20B, 38) innerhalb des ersten Rahmeninnenraumes (S_1) angeordnet ist, und der zweite Schlittenabschnitt (24) einen zweiten Rahmen (28) aufweist, der zumindest teilweise einen Innenraum (S_2) abgrenzt, wobei der erste Rahmen (26) zumindest teilweise innerhalb des zweiten Rahmeninnenraumes (S_2) anordenbar ist, sodass der zweite Schlittenabschnitt (24) teleskopverschiebbar bezüglich des ersten Schlittenabschnitts (22) ist,

einem ersten horizontalen Stellglied (19) mit einer Zentralachse (160), das mit der Basis (12, 20A, 20B, 38) verbunden ist und zum linearen Verstellen des ersten Schlittenabschnitts (22) bezüglich der Basis (12, 20A, 20B, 38) in entgegengesetzten, allgemein horizontalen Richtungen (H_1, H_2) entlang der ersten Stellgliedzentralachse (160) ausgebildet ist, und

einem zweiten horizontalen Stellglied (21) mit einer Zentralachse (161), das zum Verstellen des zweiten Schlittenabschnitts (24) bezüglich des ersten Schlittenabschnitts (22) in entgegengesetzten, allgemein horizontalen Richtungen (H_1, H_2) entlang der zweiten Stellgliedzentralachse (161) ausgebildet ist, und wobei das erste und das zweite horizontale Stellglied (19, 21) vertikal getrennt sind, sodass die erste und die zweite Stellgliedachse (160, 161) allgemein in

einer gemeinsamen Vertikalebene (P_v) angeordnet sind.

2. Ausziehbohle (10) gemäß Anspruch 1, wobei die Hauptabgleichbohle (3) eine allgemein in eine Richtung des Straßenfertigungsfahrzeugweges erstreckenden longitudinalen Zentrallinie (1a) hat und der zweite Schlittenabschnitt (24) ein räumlich seitlich von der Zentrallinie (1a) getrenntes Schlittenaußenende (14a) aufweist,
das zweite horizontale Stellglied (21) zum Verstellen des zweiten Schlittenabschnitts (24) derart ausgebildet ist, dass sich das Schlittenaußenende (14a) zwischen einer ersten Horizontalstellung (P_1), bei der das Schlittenaußenende (14a) mit einem ersten senkrechten Abstand (D_1) von der Zentrallinie (1a) beabstandet ist, und einer zweiten Horizontalposition (P_2), bei der das Schlittenseitenende (14a) einen zweiten senkrechten Abstand (D_2) von der Zentrallinie (1a) beabstandet ist, bewegt, wobei der zweite Abstand (D_2) größer ist als der erste Abstand (D_1), und
das erste horizontale Stellglied (19) zum Verstellen des ersten Schlittenabschnitts (22) derart ausgebildet ist, dass sich das Schlittenaußenende (14a) zwischen der zweiten Horizontalposition (P_2) und einer dritten Horizontalposition (P_3), bei der das Schlittenaußenende (14a) mit einem dritten senkrechten Abstand (D_3) von der Zentrallinie (1a) beabstandet ist, bewegt, wobei der dritte Abstand (D_3) größer als der zweite Abstand (D_2) ist.

3. Ausziehbohle (10) gemäß Anspruch 2, wobei die Hauptabgleichbohle (3) ein seitliches Außenende (3a) beabstandet in einem vierten senkrechten Abstand (D_4) von der Zentrallinie (1a) hat und zumindest der zweite und der dritte Abstand (D_2, D_3) jeweils größer als der vierte Abstand (D_4) sind, sodass die Ausziehbohle (10) sich seitlich nach außen von der Hauptabgleichbohle (3) erstreckt, wenn das Schlittenaußenende (14a) in der zweiten Horizontalposition (P_2) oder der dritten Horizontalposition (P_3) angeordnet ist.

4. Ausziehbohle (10) gemäß einem der vorhergehenden Ansprüche, wobei die Hauptabgleichbohle (3) eine in einer Richtung des Straßenfertigungsfahrzeugweges erstreckende longitudinale Zentrallinie (1a) aufweist, die Ausziehbohle (10) eine sich durch die Basis (12, 20A, 20B, 38) und den Schlitten (14) und allgemein senkrecht bezüglich der Zentrallinie (1a) erstreckende Zentralachse (25) hat, das erste horizontale Stellglied (19) zum Verstellen des Schlittens (14) allgemein entlang der Zentralachse (25) ausgebildet ist und das zweite horizontale Stellglied (21) zum Verstellen des zweiten Schlittenabschnitts (24) allgemein entlang der Zentralachse (25) ausgebildet ist.

5. Ausziehbohle (10) gemäß einem der vorhergehenden Ansprüche, ferner mit einem ersten gestreckten Führungsbauteil (76), das an dem ersten Schlittenabschnitt (22) befestigt ist und verschiebbar mit der Basis (12, 20A, 20B, 38) derart verbunden ist, dass es den ersten Schlittenabschnitt (22) mit der Basis (12, 20A, 20B, 38) bewegbar verbindet, wobei das erste Führungsbauteil (76) zum linearen Verstellen bezüglich der Basis (12, 20A, 20B, 38) ausgebildet ist, wenn das erste horizontale Stellglied (19) den ersten Schlittenabschnitt (22) bewegt, und einem zweiten gestreckten Führungsbauteil (78), das an dem zweiten Schlittenabschnitt (24) befestigt und beweglich mit dem ersten Führungsbauteil (76) verbunden ist, sodass es den zweiten Schlittenabschnitt (24) mit dem ersten Schlittenabschnitt (22) beweglich verbindet, wobei das zweite Führungsbauteil (78) zum linearen Verstellen bezüglich des ersten Führungsbauteils (76) ausgebildet ist, wenn das zweite horizontale Stellglied (21) den zweiten Schlittenabschnitt (24) bewegt.

6. Ausziehbohle (10) gemäß Anspruch 5, wobei die Basis (12, 20A, 20B, 38) eine Lageröffnung (48A, 48B) aufweist und das erste Führungsbauteil (76) verschiebbar innerhalb der Basislageröffnung (48A, 48B) angeordnet ist.

7. Ausziehbohle (10) gemäß Anspruch 5 oder 6, wobei das erste oder das zweite Führungsbauteil (76, 78) einen gestreckten rohrförmigen Körper (77) aufweist und das jeweils andere Führungsbauteil (76, 78) eine gestreckte Stange (79) aufweist, die zumindest teilweise in dem rohrförmigen Körper (77) verschiebbar angeordnet ist, sodass die Stange (79) zum Teleskopverstellen bezüglich des rohrförmigen Körpers ausgebildet ist, wenn der zweite Schlittenabschnitt (24) bezüglich des ersten Schlittenabschnitts (22) verstellt wird.

8. Ausziehbohle (10) gemäß einem der vorhergehenden Ansprüche, wobei der erste Schlittenabschnitt (22) ein Schienenbauteil (87) aufweist und der zweite Schlittenabschnitt (24) ein Gleitbauteil (107) aufweist, welches auf dem Schienenbauteil (87) verschiebbar angeordnet ist, sodass der erste Schlittenabschnitt (22) zumindest teilweise das Gewicht des zweiten Schlittenabschnitts (24) trägt und das Gleitbauteil (107) auf der Schiene (87) verstellt wird, wenn der zweite Schlittenabschnitt (24) bezüglich der Basis (12, 20A, 20B, 38) verstellt wird.

9. Ausziehbohle (10) gemäß einem der vorhergehenden Ansprüche, wobei die Hauptabgleichbohle (3) eine sich allgemein in eine Richtung des Straßenfertigungsfahrzeugweges erstreckenden longitudinalen Mittellinie (1a) hat, der erste Schlittenabschnitt (22) ein Innenseitenende (83) und das erste horizon-

tale Stellglied (19) einen Hydraulikzylinder (154) mit einer verstellbaren Stange (158) aufweist, wobei die erste Zylinderstange (158) an dem Schlitteninnenseitenende (83) derart befestigt ist, dass ein Zurückziehen der Stange (158) zum Verstellen des Schlittens (14) allgemein weg von der Zentrallinie (1a) ausgebildet ist und ein Ausfahren der Stange (158) zum Verstellen des Schlittens (14) allgemein hin zur Zentrallinie (1a) ausgebildet ist.

10. Ausziehbohle (10) gemäß einem der vorhergehenden Ansprüche, wobei die Basis (12, 20A, 20B, 38) einen ersten Körper (20A) und einen zweiten Körper (20B), der horizontal von dem ersten Körper (20A) beabstandet ist, aufweist, wobei sich das erste und das zweiten horizontale Stellglied (19, 21) jeweils zwischen den beiden Basiskörpem (20A, 20B) erstrecken und mit jedem der beiden verbunden sind.

Revendications

1. Poutre lisseuse d'appoint (10) pour un ensemble de poutre lisseuse (1) d'un véhicule de pavage (2), l'ensemble de poutre lisseuse (1) comprenant une poutre lisseuse principale (3), la poutre lisseuse d'appoint (10) comprenant :

une base (12, 20A, 20B, 38) raccordable de manière mobile à la poutre lisseuse principale (3) ;
un actionneur vertical (16, 17A, 17B) raccordable à la poutre lisseuse principale (3) et configuré pour déplacer linéairement la base (12, 20A, 20B, 38) par rapport à la poutre lisseuse principale (3) dans des sens opposés généralement verticaux ;
un chariot (14) raccordé de manière mobile à la base (12, 20A, 20B, 38) et configuré de façon à supporter une plaque lisseuse (11), le chariot (14) comprenant une première section (22) raccordée de manière mobile à la base (12, 20A, 20B, 38) et une seconde section (24) raccordée de manière mobile à la première section (22), la première section de chariot (22) comprenant un premier châssis (26) délimitant au moins en partie un espace intérieur (S_1), la base (12, 20A, 20B, 38) étant disposée dans l'espace intérieur (S_1) du premier châssis, et la seconde section de chariot (24) comprenant un second châssis (28) délimitant au moins en partie un espace intérieur (S_2), le premier châssis (26) pouvant être disposé au moins en partie dans l'espace intérieur (S_2) du second châssis de sorte que la seconde section de chariot (24) puisse effectuer un mouvement télescopique par rapport à la première section de chariot (22) ;
un premier actionneur horizontal (19) ayant un axe central (160) et étant raccordé à la base (12, 20A, 20B, 38) et configuré pour déplacer linéairement la première section de chariot (22) par rapport à la base (12, 20A, 20B, 38) dans des sens opposés généralement horizontaux (H_1, H_2) le long de l'axe central (160) du premier actionneur ; et
un second actionneur horizontal (21) ayant un axe central (161) et étant configuré pour déplacer la seconde section de chariot (24) par rapport à la première section de chariot (22) dans des sens opposés généralement horizontaux (H_1, H_2) le long de l'axe central (161) du second actionneur ; et
dans laquelle les premier et second actionneurs horizontaux (19, 21) sont espacés l'un de l'autre verticalement de sorte que les axes (160, 161) des premier et second actionneurs soient généralement disposés dans un plan vertical commun (P_v).

2. Poutre lisseuse d'appoint (10) selon la revendication 1, dans laquelle :

la poutre lisseuse principale (3) présente un axe longitudinal (1a) s'étendant généralement dans le sens de déplacement du véhicule de pavage et la seconde section de chariot (24) fournit une extrémité externe (14a) espacée latéralement de l'axe (1a) ;
le second actionneur horizontal (21) est configuré pour déplacer la seconde section de chariot (24) de sorte que l'extrémité externe (14a) du chariot se déplace entre une première position horizontale (P_1), où l'extrémité externe (14a) du chariot est espacée d'une première distance perpendiculaire (D_1) de l'axe (1a), et une deuxième position horizontale (P_2), où l'extrémité latérale (14a) du chariot est espacée d'une deuxième distance perpendiculaire (D_2) de l'axe (1a), la seconde distance (D_2) étant plus grande que la première distance (D_1) ; et
le premier actionneur horizontal (19) est configuré pour déplacer la première section de chariot (22) de sorte que l'extrémité externe (14a) du chariot se déplace entre la deuxième position horizontale (P_2) et une troisième position horizontale (P_3), où l'extrémité externe (14a) du chariot est espacée d'une troisième distance perpendiculaire (D_3) de l'axe (1a), la troisième distance (D_3) étant supérieure à la deuxième distance (D_2).

3. Poutre lisseuse d'appoint (10) selon la revendication 2, dans laquelle la poutre lisseuse principale (3) présente une extrémité externe latérale (3a) espacée d'une quatrième distance perpendiculaire (D_4) de l'axe (1a) et au moins les deuxième et troisième distances (D_2, D_3) sont chacune supérieures à la qua-

trième distance (D_4) de sorte que la poutre lisseuse d'appoint (10) s'étende latéralement vers l'extérieur de la poutre lisseuse principale (3) lorsque l'extrémité externe (14a) du chariot est disposée dans l'une de la deuxième position horizontale (P_2) et de la troisième position horizontale (P_3).

4. Poutre lisseuse d'appoint (10) selon l'une quelconque des revendications précédentes, dans laquelle la poutre lisseuse principale (3) a un axe longitudinal (1a) s'étendant dans le sens de déplacement du véhicule de pavage, la poutre lisseuse d'appoint (10) a un axe central (25) s'étendant à travers la base (12, 20A, 20B, 38) et le chariot (14) et généralement perpendiculaire par rapport à l'axe (1a), le premier actionneur horizontal (19) est configuré pour déplacer le chariot (14) généralement le long de l'axe central (25) et le second actionneur horizontal (21) est configuré pour déplacer la seconde section de chariot (24) généralement le long de l'axe central (25).

5. Poutre lisseuse d'appoint (10) selon l'une quelconque des revendications précédentes, comprenant en outre :

un premier élément de guidage allongé (76) fixé à la première section de chariot (22) et raccordé à coulissement à la base (12, 20A, 20B, 38) de manière à raccorder de façon mobile la première section de chariot (22) à la base (12,-20A, 20B, 38), le premier élément de guidage (76) étant à même de se déplacer linéairement par rapport à la base (12, 20A, 20B, 38) lorsque le premier actionneur horizontal (19) déplace la première section de chariot (22) ; et
un second élément de guidage allongé (78) fixé à la seconde section de chariot (24) et raccordé de manière mobile au premier élément de guidage (76) de façon à raccorder de manière mobile la seconde section de chariot (24) à la première section de chariot (22), le second élément de guidage (78) étant à même de se déplacer linéairement par rapport au premier élément de guidage (76) lorsque le second actionneur horizontal (21) déplace la seconde section de chariot (24).

6. Poutre lisseuse d'appoint (10) selon la revendication 5, dans laquelle la base (12, 20A, 20B, 38) comprend une ouverture de palier (48A, 48B) et le premier élément de guidage (76) est monté à coulissement dans l'ouverture de palier (48A, 48B) de la base.

7. Poutre lisseuse d'appoint (10) selon la revendication 5 ou 6, dans laquelle l'un des premier et second éléments de guidage (76, 78) comprend un corps tubulaire allongé (77) et l'autre des premier et second éléments de guidage (76, 78) comprend un montant allongé (79) monté à coulissement en partie dans le corps tubulaire (77) de sorte que le montant (79) soit à même d'effectuer un mouvement télescopique par rapport au corps tubulaire (77) lorsque la seconde section de chariot (24) se déplace par rapport à la première section de chariot (22).

8. Poutre lisseuse d'appoint (10) selon l'une quelconque des revendications précédentes, dans laquelle la première section de chariot (22) comprend un élément de rail (87) et la seconde section de chariot (24) comprend un élément coulissant (107) monté à coulissement sur l'élément de rail (87) de sorte que la première section de chariot (22) supporte au moins en partie le poids de la seconde section de chariot (24) et que l'élément coulissant (107) se déplace sur le rail (87) lorsque la seconde section de chariot (24) se déplace par rapport à la base (12, 20A, 20B, 38).

9. Poutre lisseuse d'appoint (10) selon l'une quelconque des revendications précédentes, dans laquelle la poutre lisseuse principale (3) comprend un axe longitudinal (1a) s'étendant généralement dans le sens de déplacement du pavage, la première section de chariot (22) a une extrémité latérale interne (83) et le premier actionneur horizontal (19) comprend un cylindre hydraulique (154) ayant une tige déplaçable (158), la première tige de cylindre (158) étant fixée à l'extrémité latérale interne (83) du chariot de sorte que le retrait de la tige (158) soit à même d'écarter généralement le chariot (14) de l'axe (1a) et que l'extension de la tige (158) soit à même de déplacer le chariot (14) de manière générale vers l'axe (1a).

10. Poutre lisseuse d'appoint (10) selon l'une quelconque des revendications précédentes, dans laquelle la base (12, 20A, 20B, 38) comprend un premier corps (20A) et un second corps (20B) espacé horizontalement du premier corps (20A), les premier et second actionneurs horizontaux (19, 21) s'étendant chacun entre les deux corps de base (20A, 20B) et étant raccordés à chacun d'entre eux.

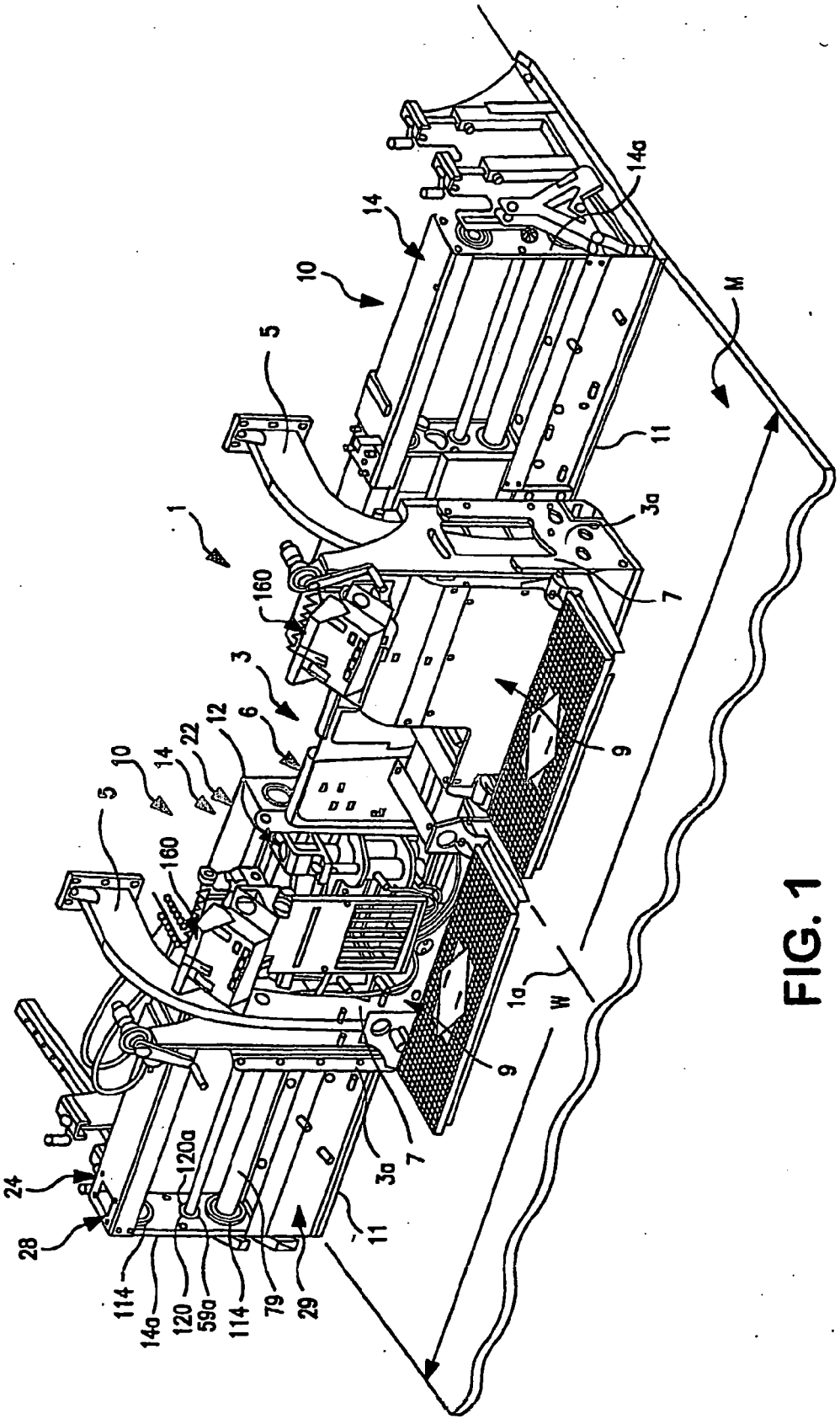
1
3
3a
5
6
7
9
10
11
12
14
14a
22
24
28
29
59a
79
114
114a
120
120a
160
1a
M
W

FIG. 1

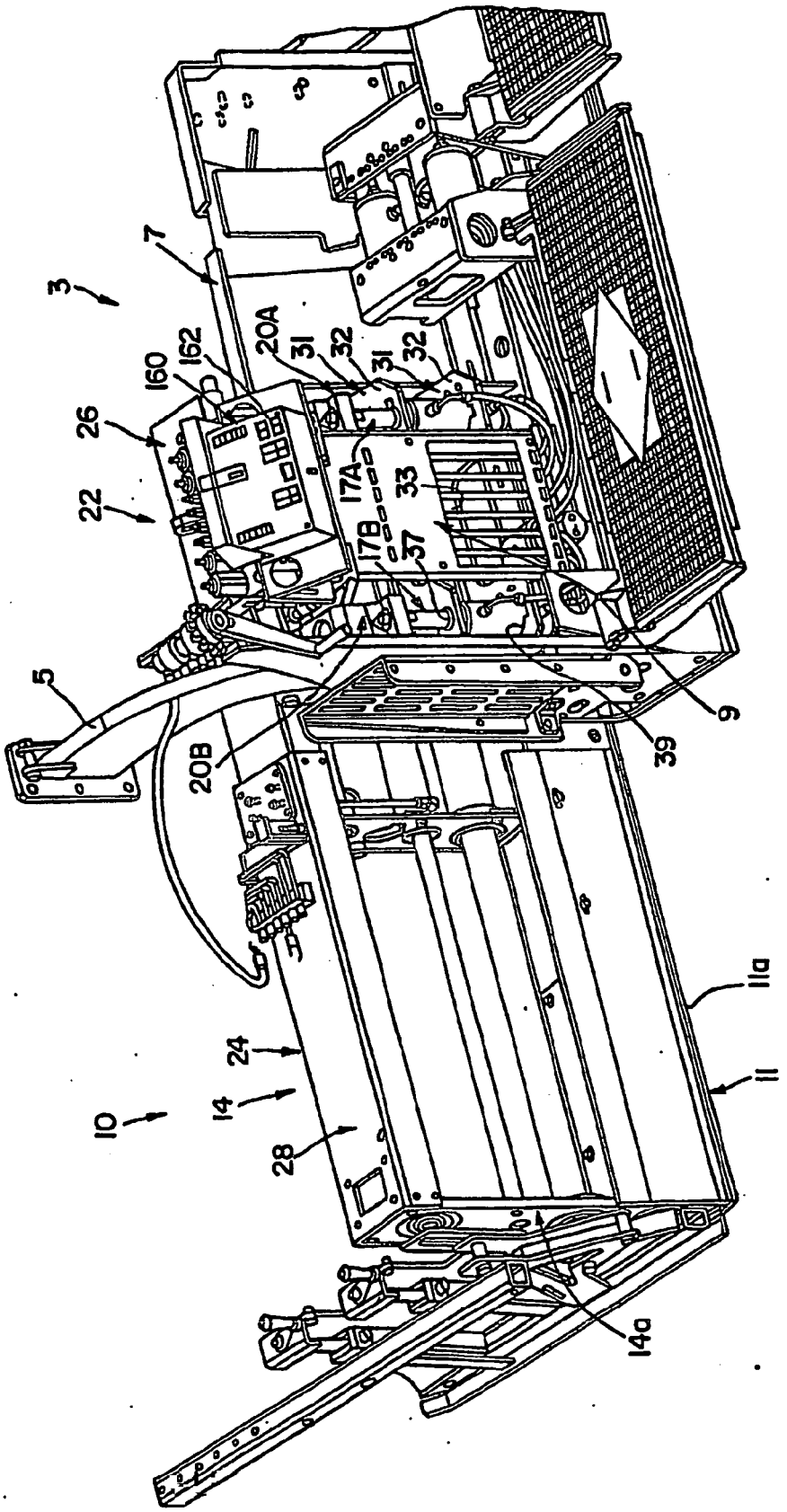
3
7
20A
31
32
31
32
160
162
26
22
17A
33
17B
37
5
9
39
20B
11a
11
24
14
10
28
14a

FIG. 2

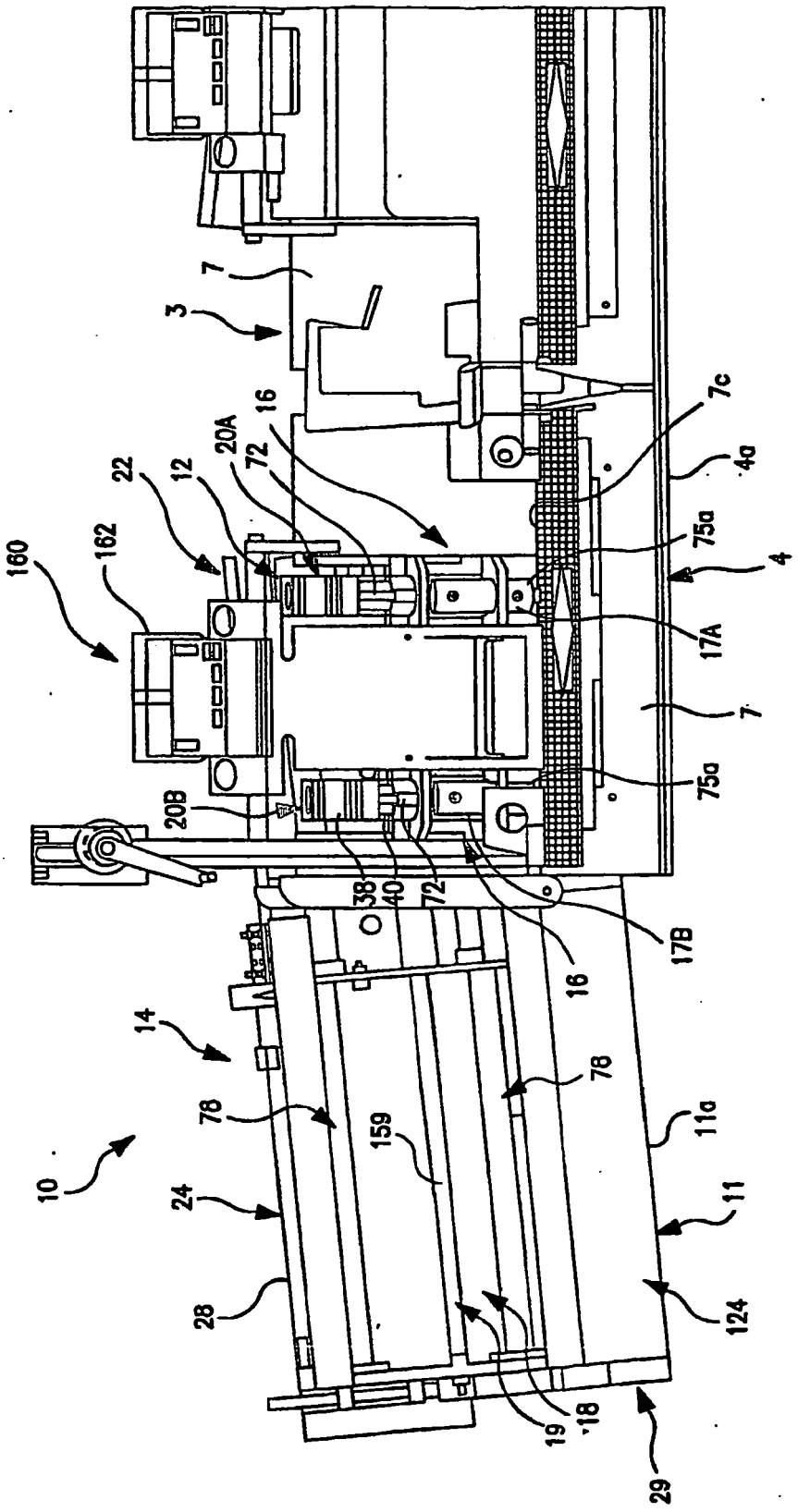
7
3
16
20A
72
22
12
160
162
7c
4a
75a
4
17A
7
75a
20B
38
40
72
17B
16
14
78
78
159
10
24
28
11a
11
124
19
18
29

FIG. 3

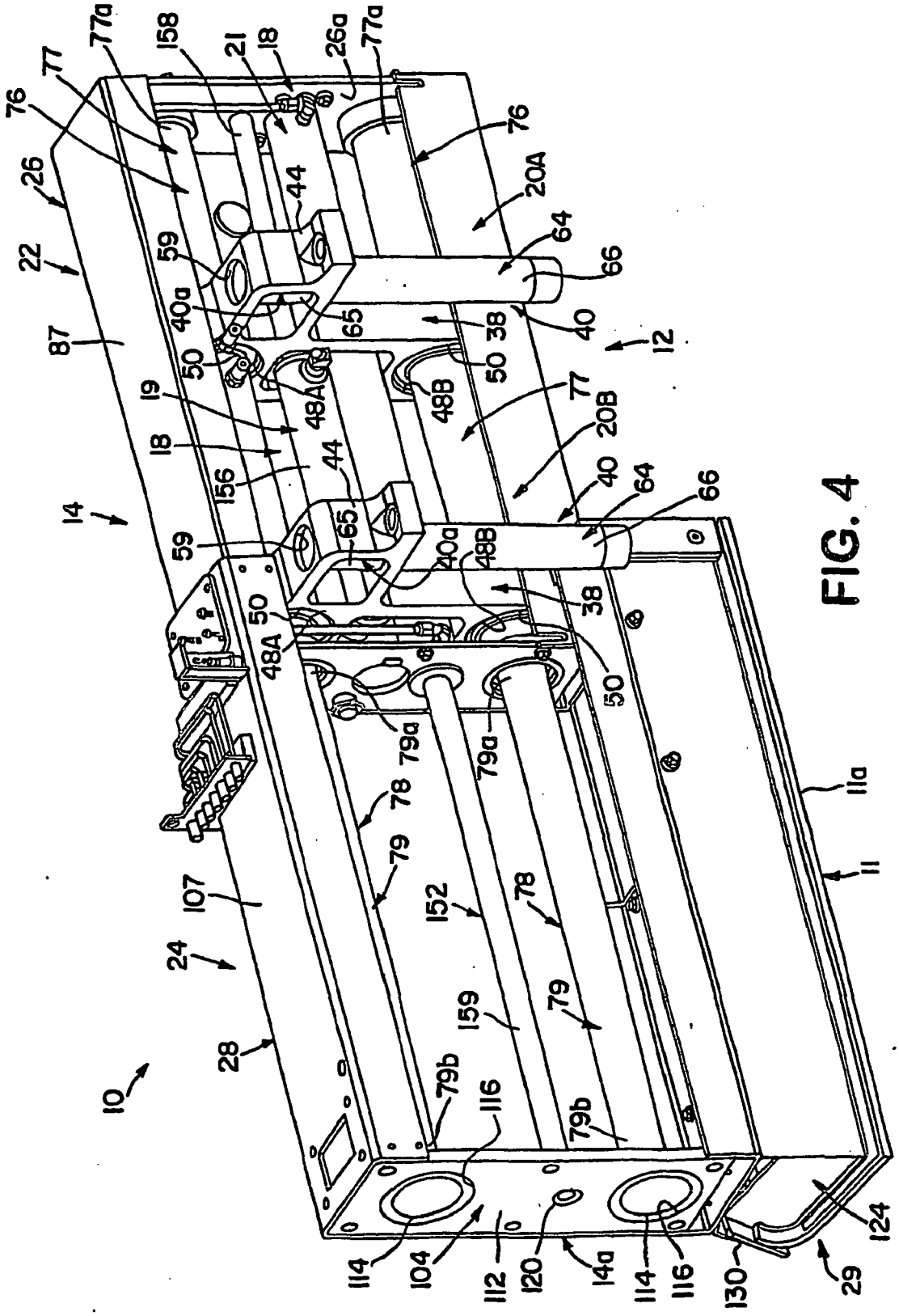
77a
158
21
18
26a
77a
77
76
26
22
87
59
40a
50
19
18
156
14
59
50
48A
44
65
79a
78
79
107
24
28
10
152
159
79b
116
114
104
112
120
14a
114
116
130
29
124
11a
11
76
20A
64
66
38
40
12
48B
77
20B
40
64
66
40a
48B
38
50
79a
78
79
159
79b

FIG. 4

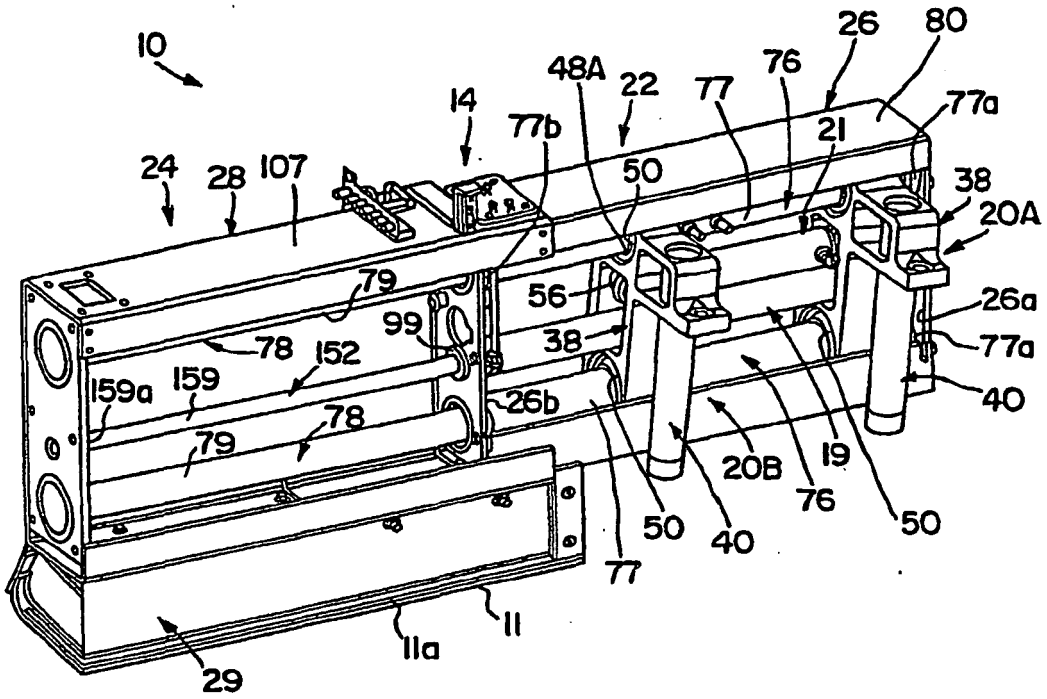
10
24
28
107
14
48A
22
77
76
26
80
77a
77b
21
50
38
20A
79
56
26a
99
38
77a
78
152
159a
159
40
26b
78
79
20B
19
76
50
40
50
77
11
11a
29

FIG. 5

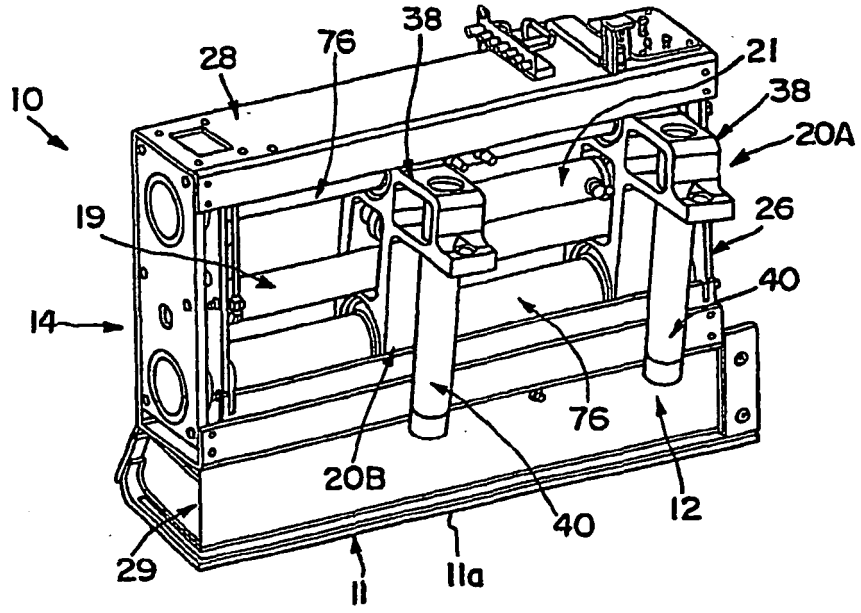
10
28
76
38
21
38
20A
19
26
40
14
76
20B
40
12
29
11
11a

FIG. 6

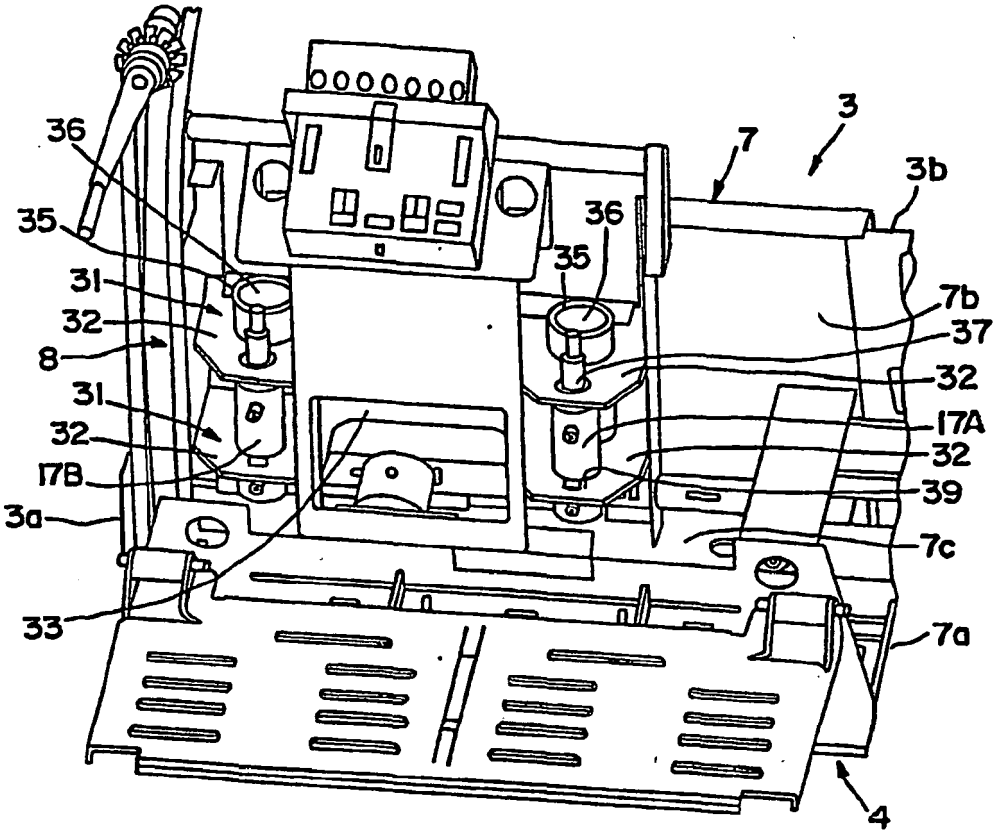
36
35
31
32
8
31
32
17B
3a
33
3
7
3b
36
35
7b
37
32
17A
32
39
7c
7a
4

FIG. 7

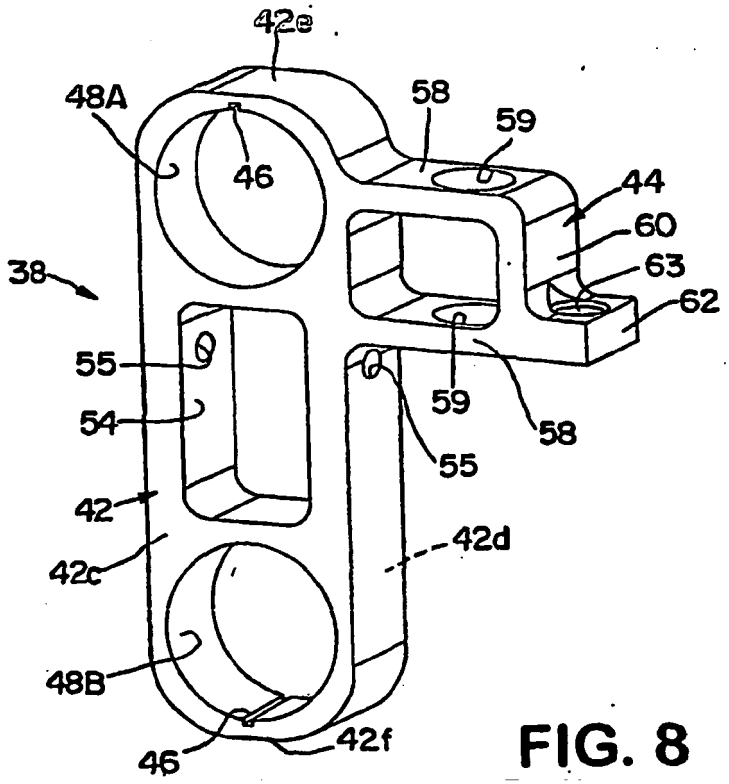
42e
48A
46
58
59
44
60
63
62
38
55
54
42
42c
48B
46
42f
59
58
55
42d

FIG. 8

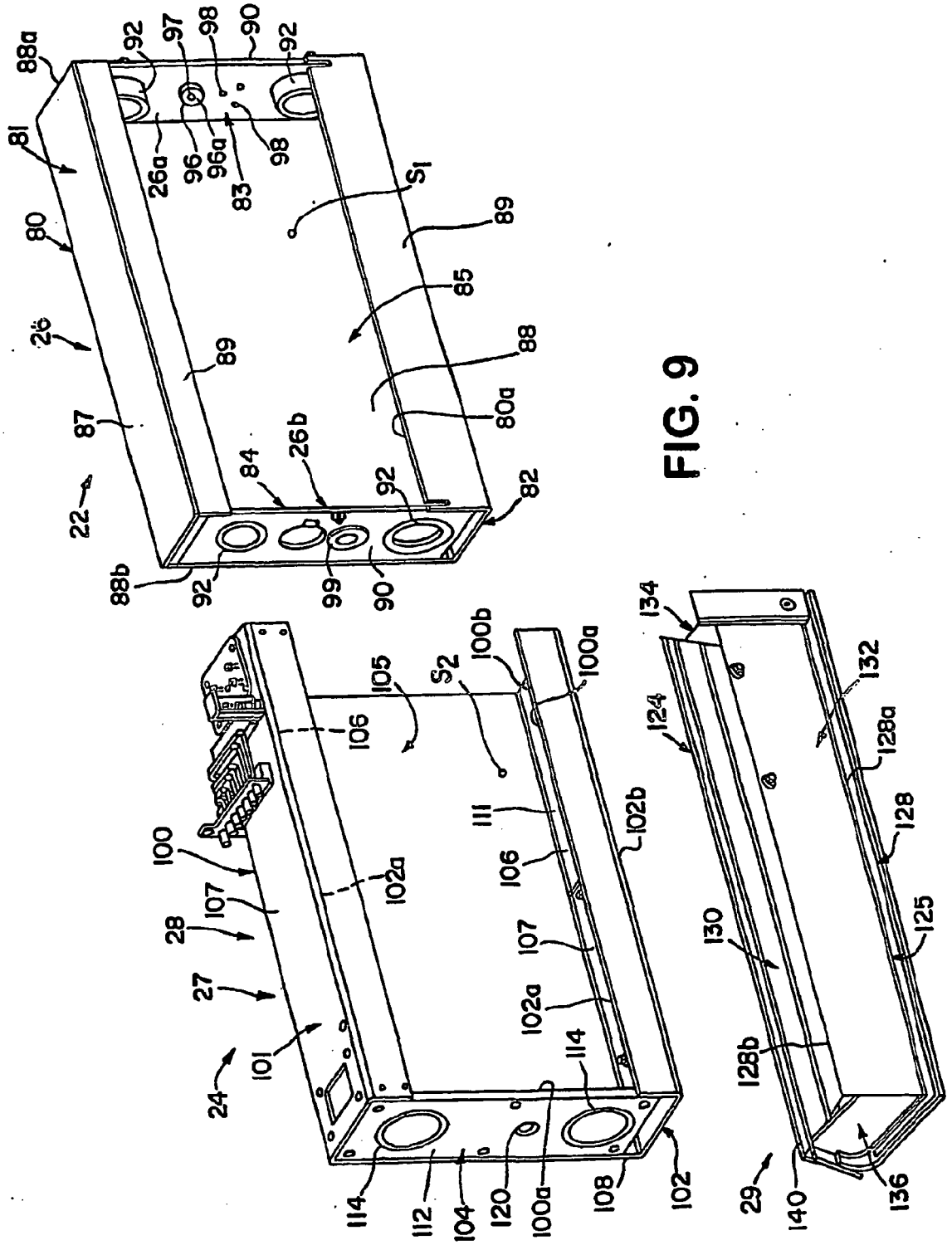
88a
92
97
98
90
92
81
80
26
87
22
88b
92
99
90
82
84
26b
92
88
80a
85
89
S1
89
26a
96
96a
83
98
100b
100a
105
S2
106
111
102b
100
102a
106
107
28
107
27
102a
101
24
114
114
112
104
120
100a
108
102
134
132
124
128a
128
125
130
128b
29
140
136

FIG. 9

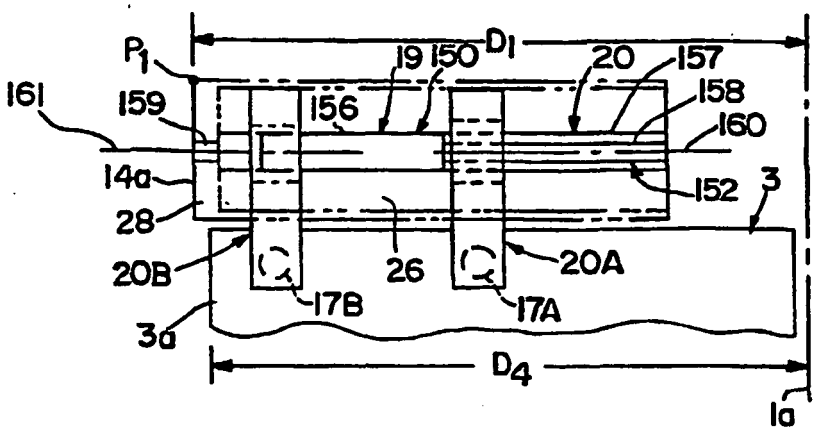

FIG. 10

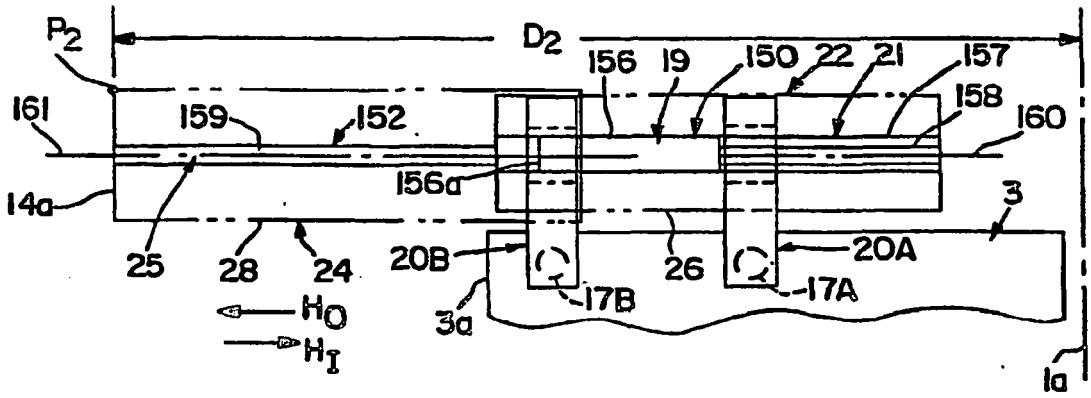

FIG. 11

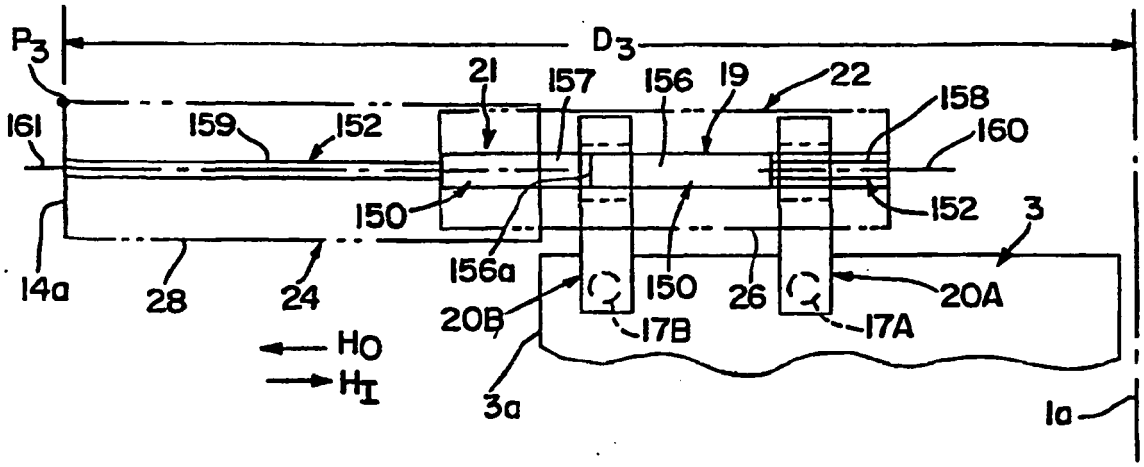

FIG. 12

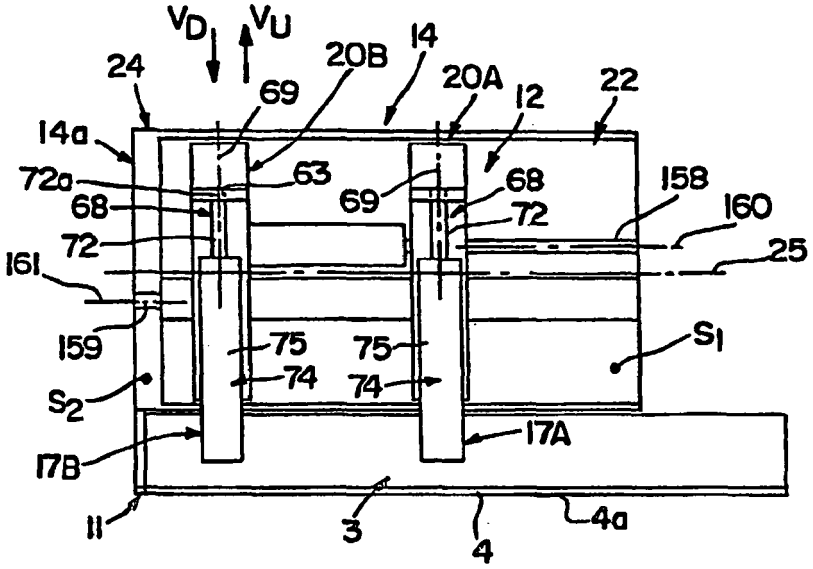
VD
VU
24
69
20B
14
20A
12
22
14a
72a
63
69
68
158
160
68
72
72
25
161
159
75
75
S1
74
74
S2
17A
17B
11
3
4
4a

FIG. 13

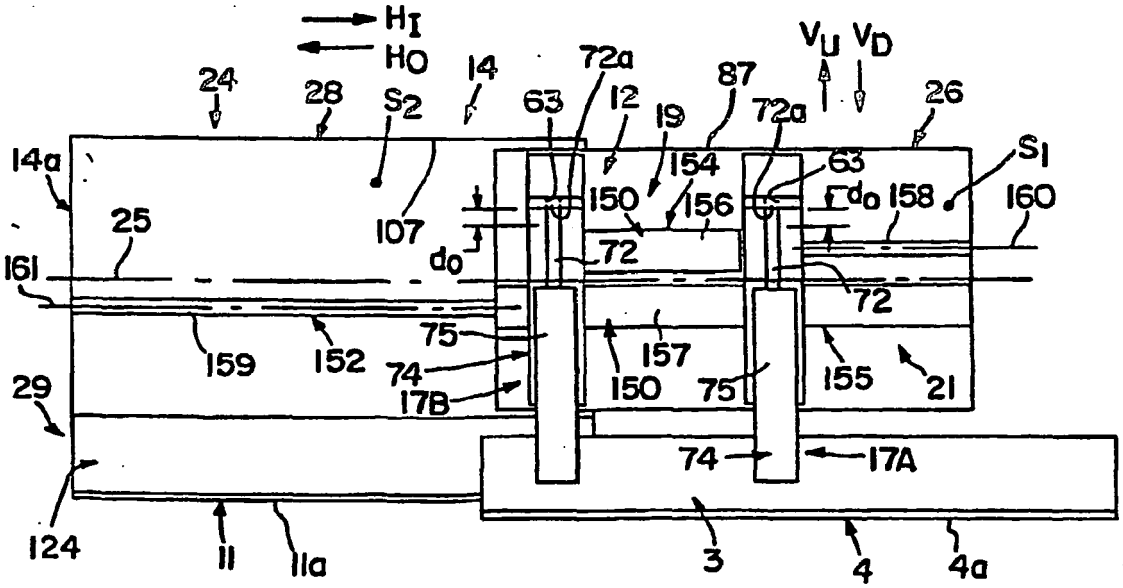
HI
HO
VU
VD
24
28
S2
14
63
72a
12
19
87
72a
26
14a
25
107
154
63
S1
150
156
do
158
160
161
do
72
72
159
152
75
157
74
155
21
29
74
17B
150
75
74
17A
124
11
11a
3
4
4a

FIG. 14

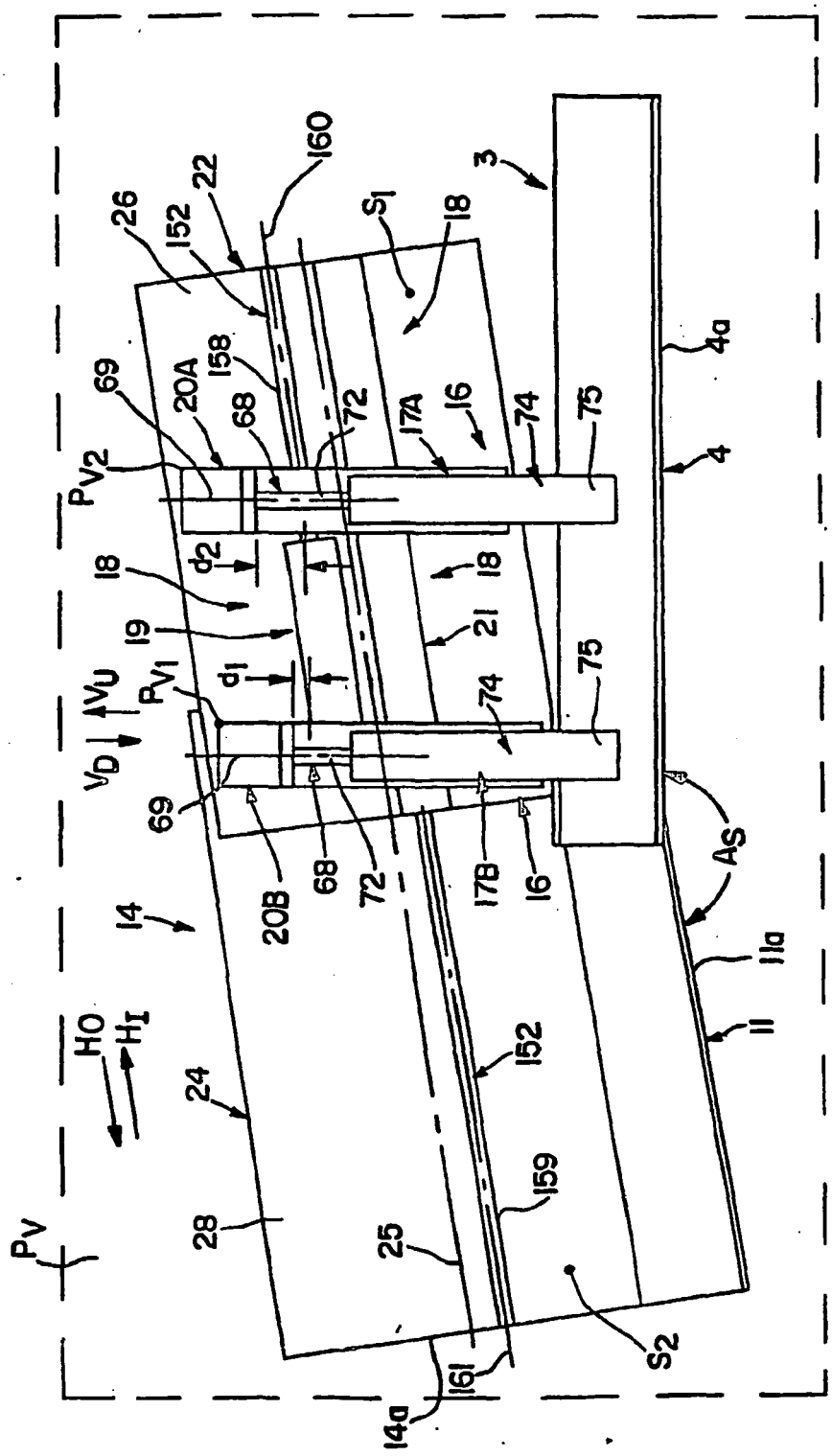
160
22
26
152
S1
18
3
4a
158
69
20A
68
72
17A
16
74
75
4
PV2
d2
18
19
21
PV1
d1
VU
VD
69
20B
68
72
17B
16
AS
14
11a
11
HO
HI
24
152
159
28
25
PV
S2
161
14a

FIG. 15

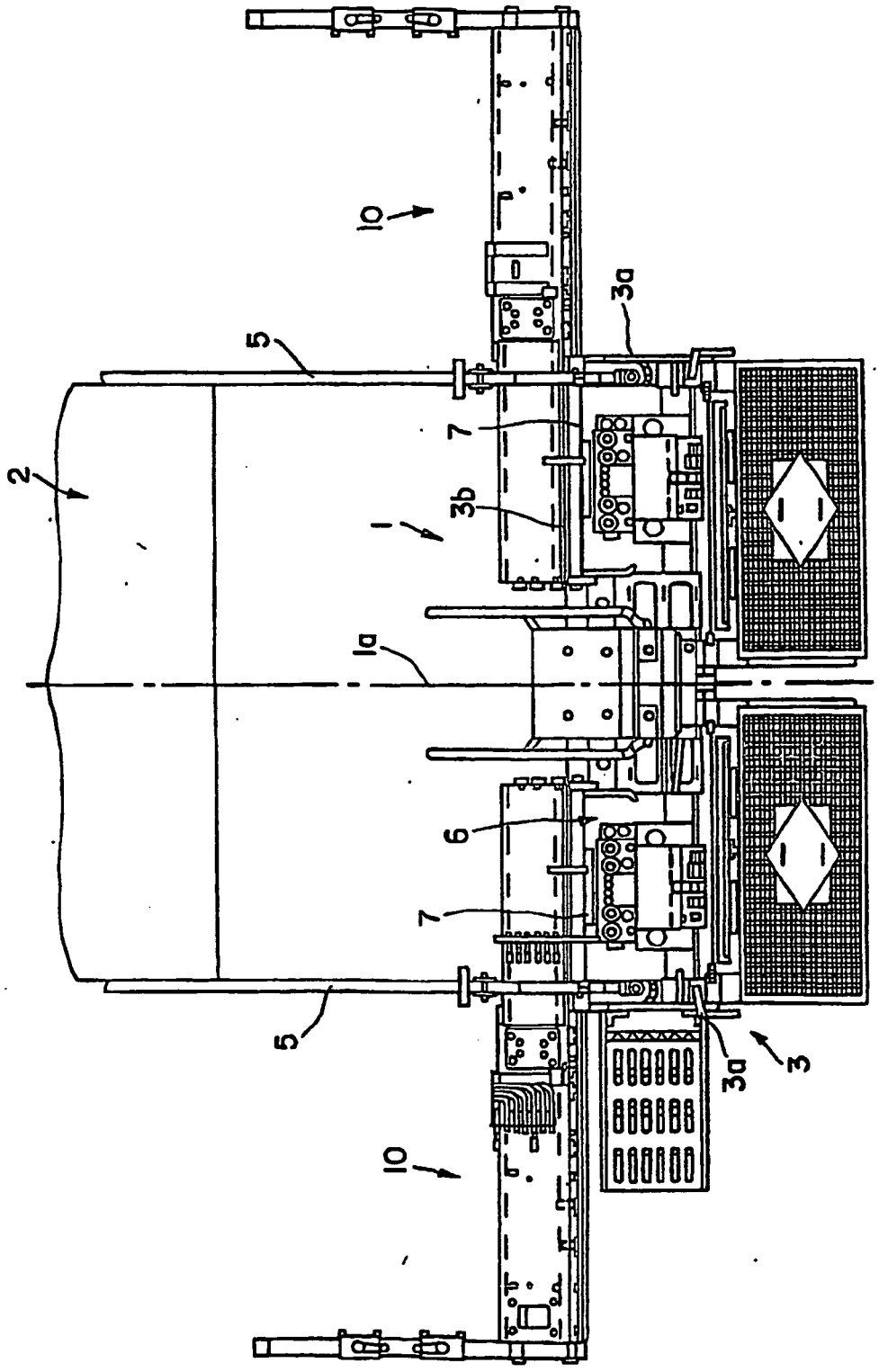

FIG. 16

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1239082 A2 **[0003]**
- DE 10028819 A1 **[0004]**